Project Management Manual
Operable Unit No. 2

South Walnut Creek

Manual No. 21100-PM

OU 02.3

EG&G ROCKY FLATS

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DOCUMENT NO QAA 2.3 REV 0

TITLE Quality Assurance Addendum for OU No.2, Interim Remedial Action, Surface Water Treatment Facility (Construction and Installation Phase)

Concurrence with the above named document is indicated by signature below

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OPERABLE UNIT NO 2
SOUTH WALNUT CREEK
INTERIM MEASURE/INTERIM REMEDIAL ACTION PLAN
SURFACE WATER
TREATMENT FACILITY
903 PAD MOUND, AND EAST TRENCHES AREA

PROJECT MANAGEMENT PLAN,
INSTALLATION AND WORK INSTRUCTIONS,
QUALITY ASSURANCE ADENDA,
SITE-SPECIFIC HEALTH AND SAFETY PLAN
FOR
CONSTRUCTION

REVISION 0

AUGUST 1991

TITLE
Project Management Plan for Interim Remedial Action for Surface Water Treatment Facility at Operable Unit No. 2

Approved by

9/12/91

Manager Remediation Programs

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LIST OF ACRONYMS

CC	Construction Coordinator
CDH	Colorado Department of Health
CFR	Code of Federal Regulations
DOE/RFO	Department of Energy/Rocky Flats Office
EMA	Environmental Monitoring and Assessment
EPA	Environmental Protection Agency
ER	Environmental Restoration
FE	Facilities Engineering
FPM	Facilities Project Management
FTU	Field Treatment Unit
GAC	Granular Activated Carbon
H&S	Health and Safety
HSC	Health and Safety Coordinator
IAG	Interagency Agreement
IM/IRA	Interim Measure/Interim Remedial Action
OU 2	Operable Unit No 2
PCE	Project Control Engineer
PE	Project Engineer
PM	Project Manager
PMP	Project Management Plan
QAA	Quality Assurance Addenda
QAC	Quality Assurance Coordinator
QAPM	Quality Assurance Program Manager
QAPP	Quality Assurance Program Plan
QAO	Quality Assurance Officer
RFP	Rocky Flats Plant
RP	Remediation Programs
RPT	Radiation Protection Technologist
WBS	Work Breakdown Structure

1 0 PROJECT BACKGROUND AND SCOPE

This document presents the Project Management Plan (PMP) for the South Walnut Creek Surface Water Interim Remedial Action (IRA) for the 903 Pad Mound and East Trenches area located at the Rocky Flats Plant (RFP) Golden Colorado The intent of this document is to define the following

- Project Scope
- Project Milestones
- Project Documents
- Key Project Personnel
- Organizational Structure
- Reporting Requirements

EG&G Rocky Flats serves as a contractor to operate and manage the U S Department of Energy (DOE) owned RFP The RFP began operations in 1951 and continues to this day to be a significant part of the DOE s nationwide nuclear weapons research development and production complex In the past storage and disposal of hazardous and radioactive wastes occurred at onsite locations at the RFP The 903 Pad Mound and East Trenches area has been designated as Operable Unit No 2 (OU 2) and consists of twenty (20) waste sites These sites were selected for remedial investigation because of the known or suspected soil surface water or groundwater contamination by volatile organic compounds radioactive elements heavy metals and other inorganic compounds Recent water quality investigations for the Surface Water Interim Measures/Interim Remedial Action Plan (IM/IRAP) for South Walnut Creek (DOE EA-0496) identified the presence of organic and radionuclide contamination of the surface water located within the OU 2 area

A portion of the Interagency Agreement (IAG) between DOE the Environmental Protection Agency (EPA) and the Colorado Department of Health (CDH) calls for DOE to initiate an IRA for the cleanup of contaminated surface water in OU 2 The Remediation Programs (RP) Division of the EG&G Environmental Restoration (ER) Department is responsible for the

planning design construction and operation of the OU 2 cleanup activities Seven point source locations illustrated by Figure 1 1 have been identified by DOE for collection and treatment One Field Treatability Unit (FTU) will be located in the South Walnut Creek drainage basin and treat surface water collected from three stations (SW59 SW61 and SW132)

A separate surface water collection system will be constructed at a later date in the Woman Creek drainage basin to transfer water collected from four seeps (SW53 SW55/77 SW63 and SW64) to a treatment facility The treated effluent will be discharged to South Walnut Creek immediately downstream of SW 132 Please refer to the South Walnut Creek IRA Plan for additional information

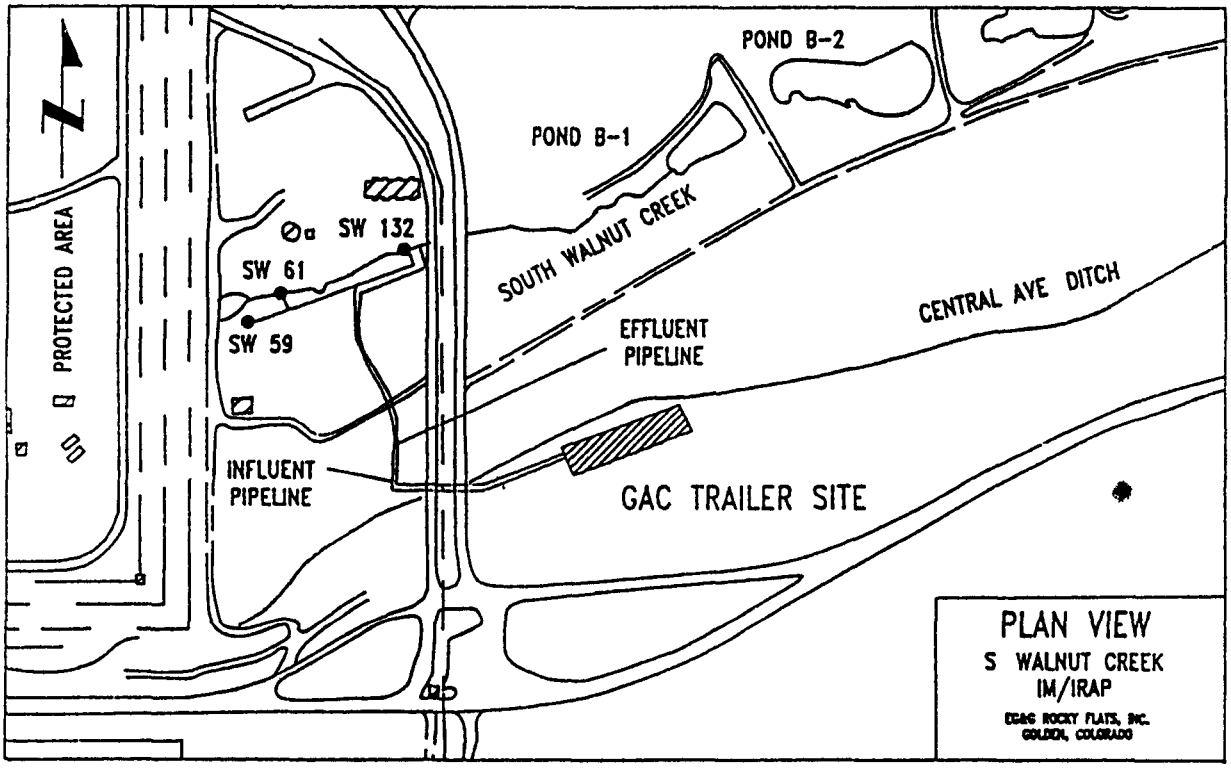
This document addresses only the tasks associated with the installation and operation of a surface water collection and transport system a Granular Activated Carbon (GAC) treatment system and a treated effluent return system all in the South Walnut Creek drainage basin The scope of activities associated with this phase of the project are as follows

- Installation of a temporary trailer to house the GAC treatment system
- Installation of two (2) collection points (SW59 and SW61) and the pipelines required to transport influent and treated effluent water
  Installation of a temporary generator to power the GAC treatment system
- Operation and maintenance of the GAC treatment system

Near term contract modifications will allow the generation of design and construction documents which will result in the addition of the third collection point at SW 132 and additional treatment facilities to remove metals and radionuclides as well as to dewater sludges produced by this treatment process

Figure 1 1

Proposed OU 2 South Walnut Creek Surface Water Treatment Facility



2 0 PROJECT MILESTONES

Completion of the major elements of work for the entire OU 2 South Walnut Creek Surface Water Treatment Facility are termed milestones Milestones serve as the basic management tool to monitor the project progress

Table 2 1 presents the milestones that correspond to defined portions of the project schedule

3 0 WORK BREAKDOWN STRUCTURE

The Work Breakdown Structure (WBS) is divided into six (6) major work scope activities Project Management Engineering Construction Health and Safety Air Monitoring and Quality Assurance The functional areas are summarized below

3 1 Project Management

The Project Manager is assigned from the EG&G Remediation Programs Division and reports to the manager of this same division The Project Manager is responsible for preparing project plans and procedures directing controlling and reporting project activities maintaining construction health and safety documents and communicating project requirements including any modifications to the project scope to the support organizations Support groups include Environmental Monitoring and Assessment (EMA) Facilities Project Management (FPM) Facilities Engineering (FE) Health and Safety (H&S) Remediation Programs and the Contractor Riedel Environmental Services Inc and its subcontractors used for this project The Project Manager will also measure project progress monitor the project budget evaluate project performance ensure compliance to health and safety issues and serve as liaison with DOE/RFO EPA and CDH The Project Manager has stop work authority The Project Manager will have regular contact with the appointed DOE Site Manager in accordance with the IAG All work will be

Table 2 1

Milestones for OU 2 South Walnut Creek Surface Water IRA

Milestone	Date
Submit Draft Proposed IM/IRA Decision Document	June 19 1990
Submit Proposed IM/IRA Decision Document to EPA/CDH	September 18 1990
Public Review of Proposed IM/IRA Decision Document	September 26 1990
Submit Draft Responsiveness Summary and Final IM/IRA Decision Document	December 13 1990
Field Treatability Test System Installation Complete	May 10 1991
Begin Field Treatability Testing	May 13 1991

performed under the day to day oversight of the Project Manager according to the project schedule and applicable health and safety requirements

3 2 Facilities Project Management

The Facilities Project Manager is assigned to the project by FPM and reports to the Project Manager The Facilities Project Manager serves as liaison between the Project Manager and FE The Facilities Project Manager assists in the design and construction phases of the project budgeting and administration scoping and scheduling activities The Facilities Project Manager provides guidance and coordinates tasks assigned to the Facilities Engineering Project Engineer (FEPE) and Construction Coordinator (CC)

3 3 Engineering

3 3 1 Facilities Engineering Project Engineer

The FE Project Engineer (FEPE) is assigned to the project by FE and reports to the FPM Project Manager as well as the Project Manager During the design and construction phases of the project the FEPE is responsible for procuring the services of an engineering design firm reviewing contractor prepared engineering design plans preparing construction and performance specifications providing as-built construction drawings and overseeing the activities of the engineering design firm and any associated plans and specifications as directed by the Project Manager Refer to the FE and FPM Manual for a complete narrative of responsibilities other than those listed above

3 3 2 Remediation Programs Project Engineer

The Remediation Programs Project Engineer (RPPE) is assigned to the project by the RPD Manager and reports to the Project Manager The RPPE coordinates engineering construction monitoring and industrial hygiene support for the project serves as backup for the Project Manager and oversees design construction and operations activities

3 4 Construction

The Construction Coordinator (CC) is assigned to the project by FPM and reports to the Facilities Project Manager All construction activities by the Contractor and its subcontractors will be conducted in accordance with EG&G approved engineering drawings and performance specifications Statements of Work Construction Work Procedures and the Quality Assurance Addenda (QAA) The CC is a point of contact in the field for the Contractor and its subcontractors The CC coordinates and/or schedules any required utility outages street closures and plant access requirements provides technical inspections of competed work and obtains all necessary plant construction work permits The CC coordinates any required safety training of contractors and ensures work is conducted in accordance with all project safety regulations The CC ensures that radiologic and industrial hygiene measurements are taken and coordinates these activities with the Radiation Protection Technologists (RPTs) and Industrial Hygienists The CC records all work progress and prepares punch lists and other reports on subcontractor performance The FE and FPM Manual outlines any other duties of the CC The CC has stop work authority if project construction health and safety or quality criteria are not met

3 5 Health and Safety

The Health and Safety Liaison Officer (HSLO) is assigned by the Occupational Safety Manager and reports to the Project Manager The HSLO is responsible for coordinating all health and safety related activities for the project including securing the services of a Health and Safety Coordinator (HSC) Health Physicists Industrial Hygienists and Safety Engineers as necessary The HSC monitors the OU 2 Surface Water Treatment Facility requirements as outlined in the QAA (for construction and operation activities) and the Contractor s OU 2 South Walnut Creek Surface Water Treatment Facility Site Specific Health and Safety Plan The HSC monitors construction for personal protection and industrial safety considerations conducts health and safety worksite inspections documents health and safety audits and reviews all health and safety related submittals prior to issuance The Contractor shall develop implement and monitor a site specific health and safety plan

All EG&G employees subcontractors and their personnel who are assigned to this project are required to have all of the requisite training satisfying 29 CFR (Code of Federal Regulations) 1910 and 1926 The HSC or designees have stop work authority for all safety-related criteria

3 6 Air Monitoring

The Air Programs Task Leader is assigned to the project by EMA and reports to the Project Manager The Air Programs group monitors meteorology and air quality for the ER Department The Air Programs Task Leader is responsible for operation of high volume air samplers and reporting of air monitoring data All analyzed air monitoring samples shall be reported immediately to the Project Manager Wind conditions will be reported to the Project Manager the CC and the HSC as specified in the Construction and Operations Procedures

3 7 Quality Assurance

3 7 1 Quality Assurance Program Manager

The Quality Assurance Program Manager (QAPM) is assigned to the project by and reports to the ER Department Director The QAPM

- Provides guidance and consultation for implementing the requirements of the ER Department Quality Assurance Program requirements
- Is responsible for the review and tracking of matters involving nonconformances and those requiring corrective action
- Is responsible for the approval of nonconformance and corrective action resolution
- Is responsible for supporting the RP Division Quality Assurance Coordinator as appropriate
  Is responsible for reporting issues involving matters adverse to quality to the ER Department Director and RP Division Manager
- Has stop work authority in matters adverse to quality

3 7 2 Quality Assurance Coordinator

The Quality Assurance Coordinator is assigned to the project by and reports to the RP Division Manager The Quality Assurance Coordinator

- Is responsible for incorporating quality inspection and records requirements into internal EG&G OU 2 South Walnut Creek Surface Water Treatment Facility project related plans procedures and instructions that affect quality
- Is responsible for conducting RP surveillance activities of the work being performed

- Is responsible for recommending corrective action on matters requiring corrective action resolution
- Is responsible for ensuring that quality records of the project are forwarded to the Records file
- Is responsible for reporting issues involving matters adverse to quality to the RP Division Manager and Project Manager
- Is responsible for compiling a final OU 2 South Walnut Creek Surface Water Treatment Facility Project Quality Report to be submitted to the RP Division Manager the ER Department Director the ER Department QAPM and the Records file upon completion of the project
- Shall coordinate quality matters with the ER Department QAPM

4 0 PROJECT BUDGET

The budget for the OU 2 South Walnut Creek Surface Water Treatment Facility IRA will be tracked by the Program Planning and Control group The Program Planning and Control Manager will assign a Project Control Engineer (PCE) to the project The PCE will report budget and cost information to the Project Manager

5 0 ORGANIZATIONAL STRUCTURE AND KEY PERSONNEL

Figure 5 1 presents the EG&G functional organizational structure and Figure 5 2 illustrates the EG&G project management structure for the OU 2 South Walnut Creek Surface Water Treatment Facility design and construction work

Figure 5 3 illustrates the EG&G project management structure for the OU 2 South Walnut Creek Surface Water Treatment Facility operations activities

Figure 5 1
OU2 SOUTH WALNUT CREEK SURFACE WATER TREATMENT PROJECT
Organization chart

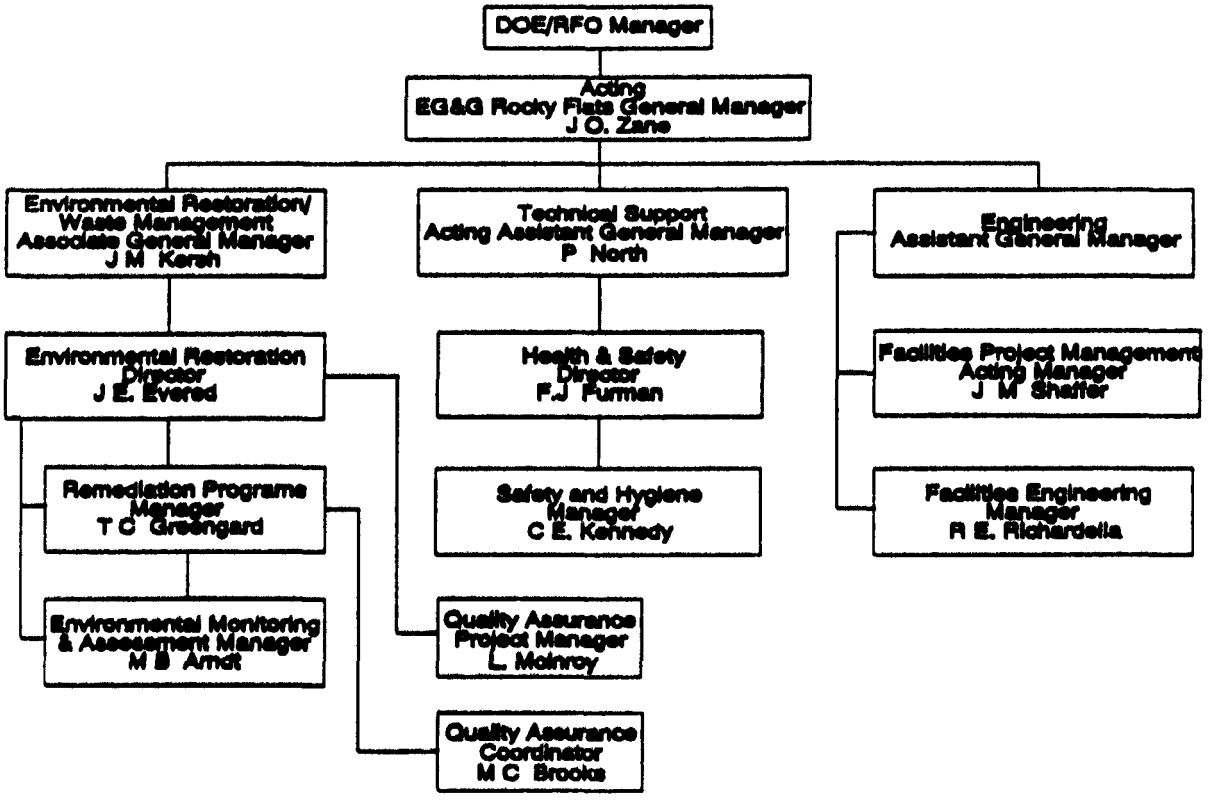


Figure 5.2
OU-2 SOUTH WALNUT CREEK IRA SURFACE WATER TREATMENT FACILITY PROJECT MANAGEMENT FOR CONSTRUCTION

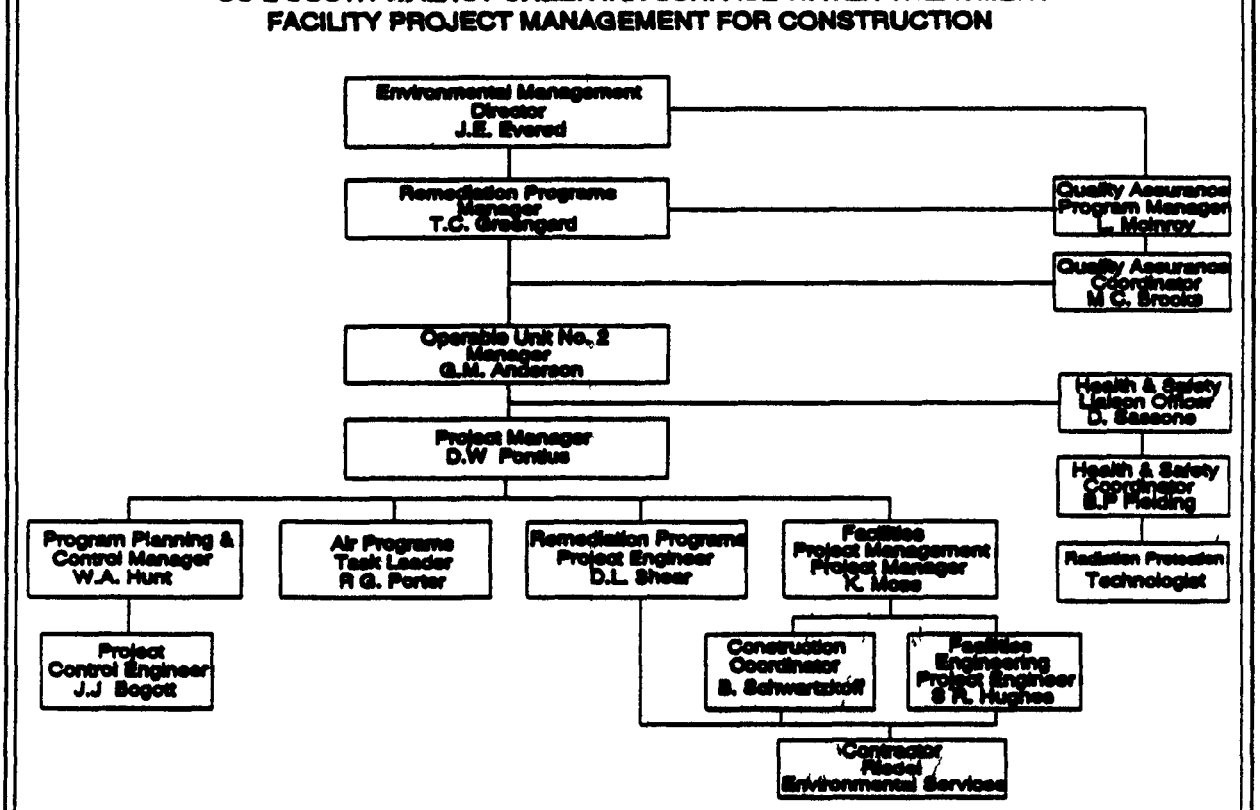
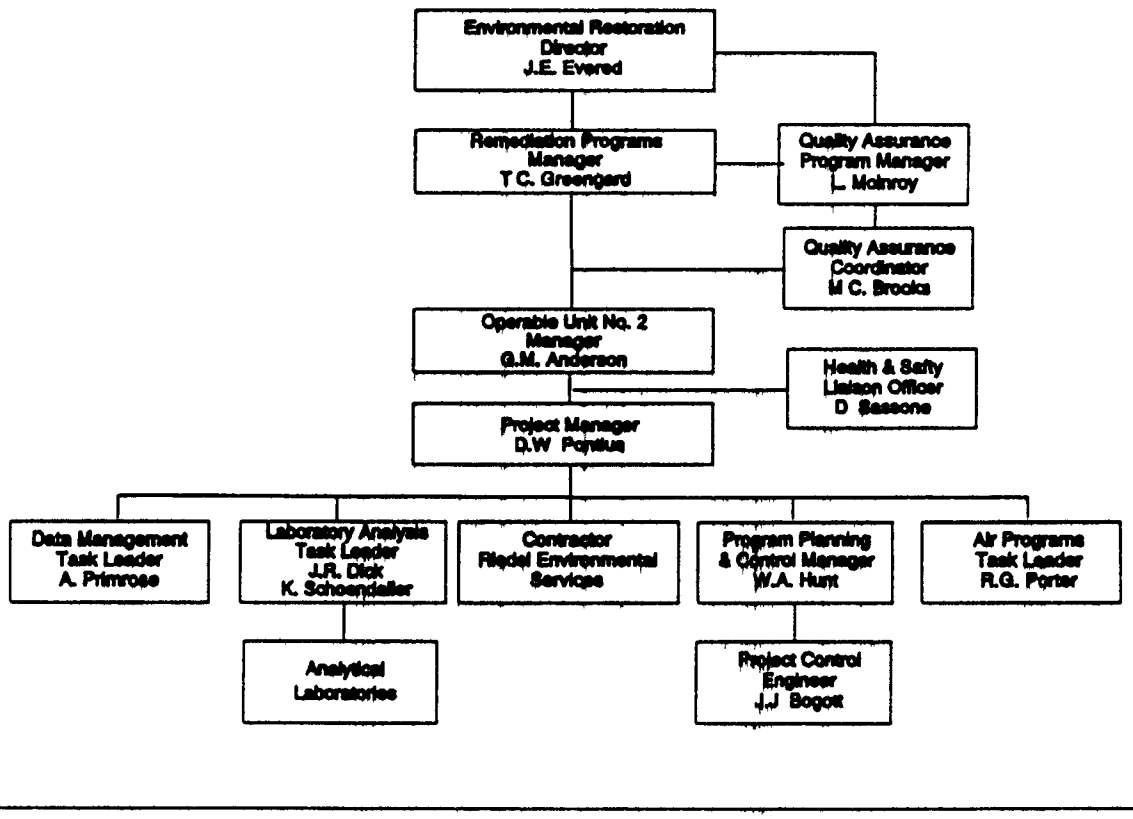


Figure 5 3
OU2 SOUTH WALNUT CREEK IRA
SURFACE WATER TREATMENT FACILITY
PROJECT MANAGEMENT FOR OPERATIONS



6 0 PROJECT REPORTS

Progress and cost reporting of activities relating to the OU 2 South Walnut Creek Surface Water Treatment Facility IRA are the responsibility of the Project Manager However each EG&G functional organization will be responsible for its own internal tracking and reporting Reporting requirements may include

- Construction Report including results of quality control tests and as built drawings
- Health and Safety Reports

  Quality Assurance Reports

7 0 PROJECT CHANGE CONTROL

A change control methodology will be utilized for the OU 2 South Walnut Creek Surface Water Treatment Facility IRA to allow the orderly handling of project changes Changes required during the design and construction phases will be controlled by change orders handled by the FE and Facilities Project Manager

8 0 PERSONNEL CHANGES

If key personnel changes are made the effect of the change on the project deliverable dates and quality will be assessed by the Project Manager If a significant impact on the project is anticipated the Project Manager will notify the OU 2 Manager so that EG&G management can take corrective action

9 0 PROJECT CONTROL DOCUMENTS

The documents that control project activities are listed below

- Operable Unit No 2 Interim Measure/Interim Remedial Action Plan for South Walnut Creek

Project Management Plan

Facilities Engineering and Project Management Manual

- Work Procedures for Granular Activated Carbon Treatment System Installation
- Granular Activated Carbon Operation and Maintenance Manual
- Contract and Project Work Plans for Riedel Environmental Services Inc
- Environmental Restoration Standard Operating Procedures
- Environmental Restoration Site Wide Quality Assurance Program Plan
- Quality Assurance Addenda

Rocky Flats Site Wide Health and Safety Plan

Contractor Health and Safety Plan

- Confined Space Entry Permit
- Excavation Permit
- Welding Permit
- Work Permit
- Project Photographs
- Engineering design plans construction specifications approved shop drawings and as built drawings and all approved modifications to drawings

These documents will be located in T130B Building 130 and at the job site Construction quality assurance and health and safety records also will be maintained at T130B and at the job site Records will be maintained by the respective document custodian identified in Table 9 1 Table 9 2 presents the responsible personnel and the appropriate backups of the project management structure

Table 9 1

Project Records and Custodians

Record	Custodian
Project Specifications and Drawings Addenda and Change Orders	Steve Hughes FE Bldg 130
Construction Coordinator s Log	Bill Schwartzkoff FPM Bldg 690E
Project Manager s Log	Dennis Pontius RPD Bldg T130B
QA Audits and Records	Mark Brooks RPD Bldg T130B
Health and Safety Documentation (Documentation kept at site)	Dennis Pontius RPD Bldg T130B
Site Entry Log (Log kept at site)	Dennis Pontius RPD Bldg T130B

Table 9 2

Project Management Backup Listing

Title	Name	Backup
Project Manager	Dennis Pontius ext 5536	Dixie Shear ext 5976
Facilities Project Manager	Ken Moss ext 5017	Jay Clawson ext 5023
Construction Coordinator	Bill Schwartzkoff ext 5626	Herb Atchison ext 5161
Project Engineer	Steve Hughes ext 7743	Mickey Johnson ext 5033
HS Engr Site Rep	Dina Sassone ext 2190	Brian Fielding ext 5798
Air Programs Rep	Ralph Porter ext 5603	Mike Arndt ext 4294
QA Program Manager	Larry McInroy ext 2941	Mark Brooks ext 3048
Security Shift Supt	ext 2914	

QUALITY ASSURANCE ADDENDUM

QAA 2 3

to the

ROCKY FLATS SITE-WIDE QA PROJECT PLAN
OPERABLE UNIT NO 2

SOUTH WALNUT CREEK
INTERIM REMEDIAL ACTION
SURFACE WATER TREATMENT FACILITY
(CONSTRUCTION AND INSTALLATION)

U S DEPARTMENT OF ENERGY
ROCKY FLATS PLANT
GOLDEN, COLORADO

ENVIRONMENTAL RESTORATION PROGRAM
ROCKY FLATS PLANT

REVISION 0
AUGUST 1991

REVIEWED FOR CLASSIFICATION
By
Date 9/3/91

TITLE
Quality Assurance Addendum to the Rocky Flats
Site Wide Quality Assurance Project Plan for Operable
Unit No 2, Surface Water Treatment Facility

Approved By

9/13/91
Manager Remediation Programs

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List of Acronyms

ASME	American Society of Mechanical Engineers
CERCLA	Comprens Environ Response Compensation and Liabilities Act
CC	Construction Coordinator
CDH	Colorado Department of Health
CFR	Code of Federal Regulations
DOE	Department of Energy
EPA	U S Environmental Protection Agency
EM	Environmental Management
FE	Facilities Engineering
FEPE	Facilities Engineer Project Engineer
FPM	Facilities Project Management
GAC	Granular Activated Carbon
HSC	Health and Safety Coordinator
IAG	Interagency Agreement
IRA	Interim Remedial Action
OU 2	Operable Unit No 2
PM	Project Manager
PMP	Project Management Plan
QA	Quality Assurance
QAA	Quality Assurance Addendum
QAPjP	Rocky Flats Plant Site Wide Quality
QAPM	Assurance Project Plan
RCRA	Quality Assurance Program Manager
RFI/CMS	Resource Conservation and Recovery Act RCRA Facility Investigation/Corrective Measures Study
RFP	Rocky Flats Plant
RI/FS	Remedial Investigation/Feasibility Study
RP	Remediation Programs
RPT	Radiation Protection Technologist
SOPs	Standard Operating Procedures

INTRODUCTION AND SCOPE

This Quality Assurance Addendum (QAA) supplements the Rocky Flats Plant Site Wide Quality Assurance Project Plan (QAPjP) for the installation of the Operable Unit No 2 (OU 2) Surface Water Treatment Facility in South Walnut Creek This QAA establishes the specific Quality Assurance (QA) controls applicable to the OU 2 Interim Remedial Action (IRA) construction and installation activities described in the OU 2 South Walnut Creek Surface Water Treatment Facility Project Management Plan for the Granular Activated Carbon (GAC) Treatment System A separate QAA will be developed for the operation of the GAC Treatment System which will accompany the OU 2 IRA Sampling and Analysis Plan

The OU 2 South Walnut Creek IRA is required by the Interagency Agreement (IAG) between the U S Department of Energy (DOE) the U S Environmental Protection Agency (EPA) and the Colorado Department of Health (CDH) to treat contaminated surface water in the South Walnut Creek drainage basin

Surface water will be collected initially from two stations within South Walnut Creek and transported to the Field Treatability Unit A third collection station will be added as modifications are made to the treatment system after operations begin The influent water will initially be treated with a GAC system to remove organic compounds metals and radionuclides The treated effluent will be discharged downstream to South Walnut Creek Additional treatment units will be designed and retrofitted with the GAC system for full removal of radionuclides and metals The GAC treatment system construction and operation activities are addressed in this QAA Please refer to the OU 2 South Walnut Creek Surface Water Treatment System Project Management Plan (PMP) for additional information

1 0 ORGANIZATION AND RESPONSIBILITIES

The OU 2 South Walnut Creek Surface Water Treatment Facility Project Management System for the construction and operation phases of the OU 2 IRA are shown in Figures 1 and 2 Individual responsibilities with regard to QA are described in detail in QAPjP Section 1 0 Additional responsibilities for the construction and installation phase of the South Walnut Creek IRA for the Facilities Project Manager Project Engineer Construction Coordinator and Health and Safety Coordinator are as follows

Facilities Project Manager

The Facilities Project Manager is assigned to the project by Facilities Project Management (FPM) and reports to the Project Manager The Facilities Project Manager serves as liaison between the Project Manager and Facilities Engineering (FE) The Facilities Project Manager assists in the design and construction phases of the project budgeting and administration scoping and scheduling activities The Facilities Project Manager provides guidance and coordinates tasks assigned to the Facilities Engineering Project Engineer and Construction Coordinator

Project Engineer

The Facilities Engineering Project Engineer (FEPE) is assigned to the project by FE and reports to the Facilities Project Manager in FPM as well as the Project Manager During the design and construction phases of the project the FEPE is responsible for procuring the services of an engineering design firm reviewing contractor prepared engineering design plans preparing construction and performance specifications providing as built construction drawings and overseeing the activities of the engineering design firm and any associated plans and specifications as directed by the Project Manager Refer to the FE and FPM Manual for a complete narrative of responsibilities other than those listed above

FIGURE 1 OU 2 IRA CONSTRUCTION MANAGEMENT SYSTEM

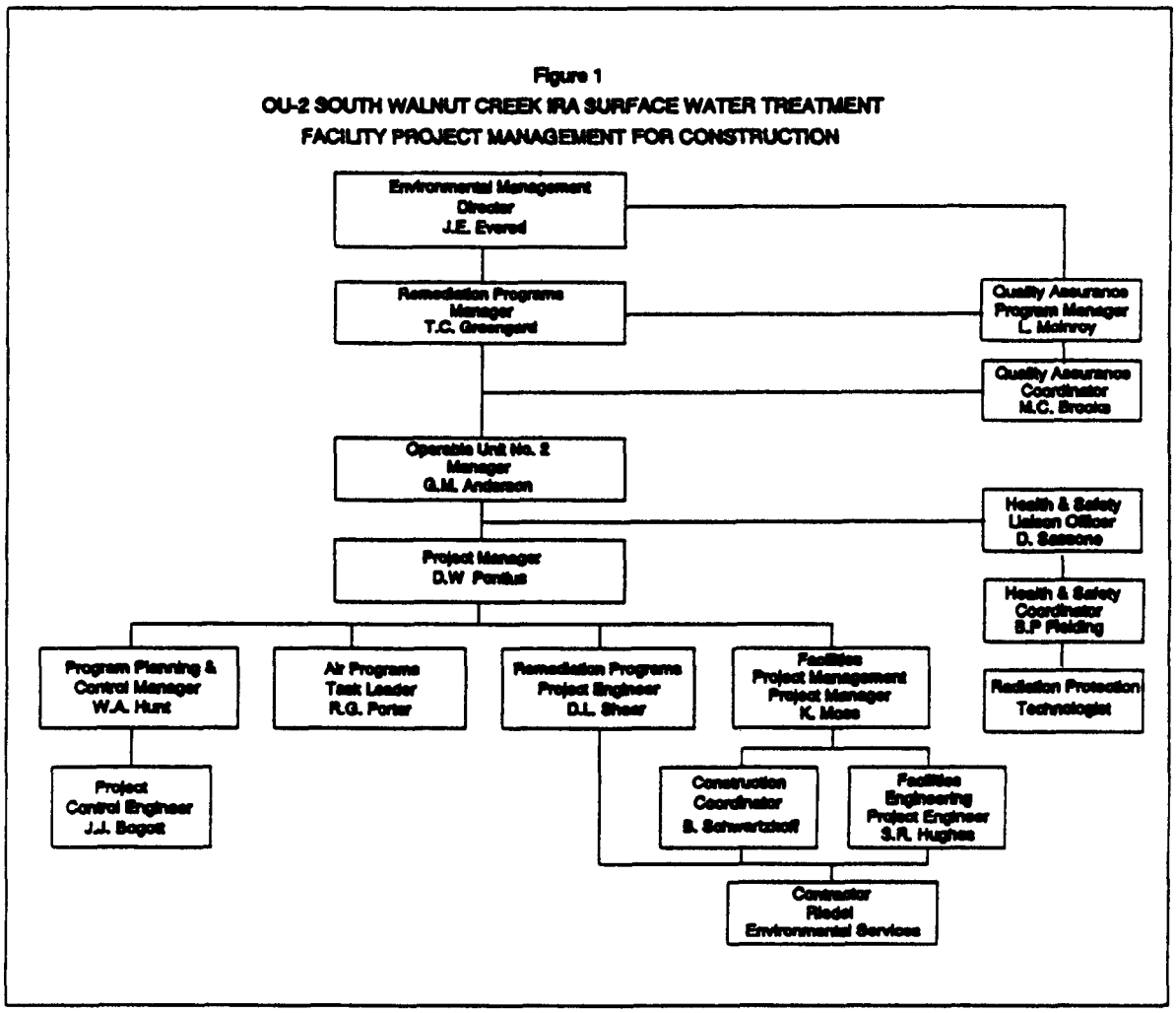
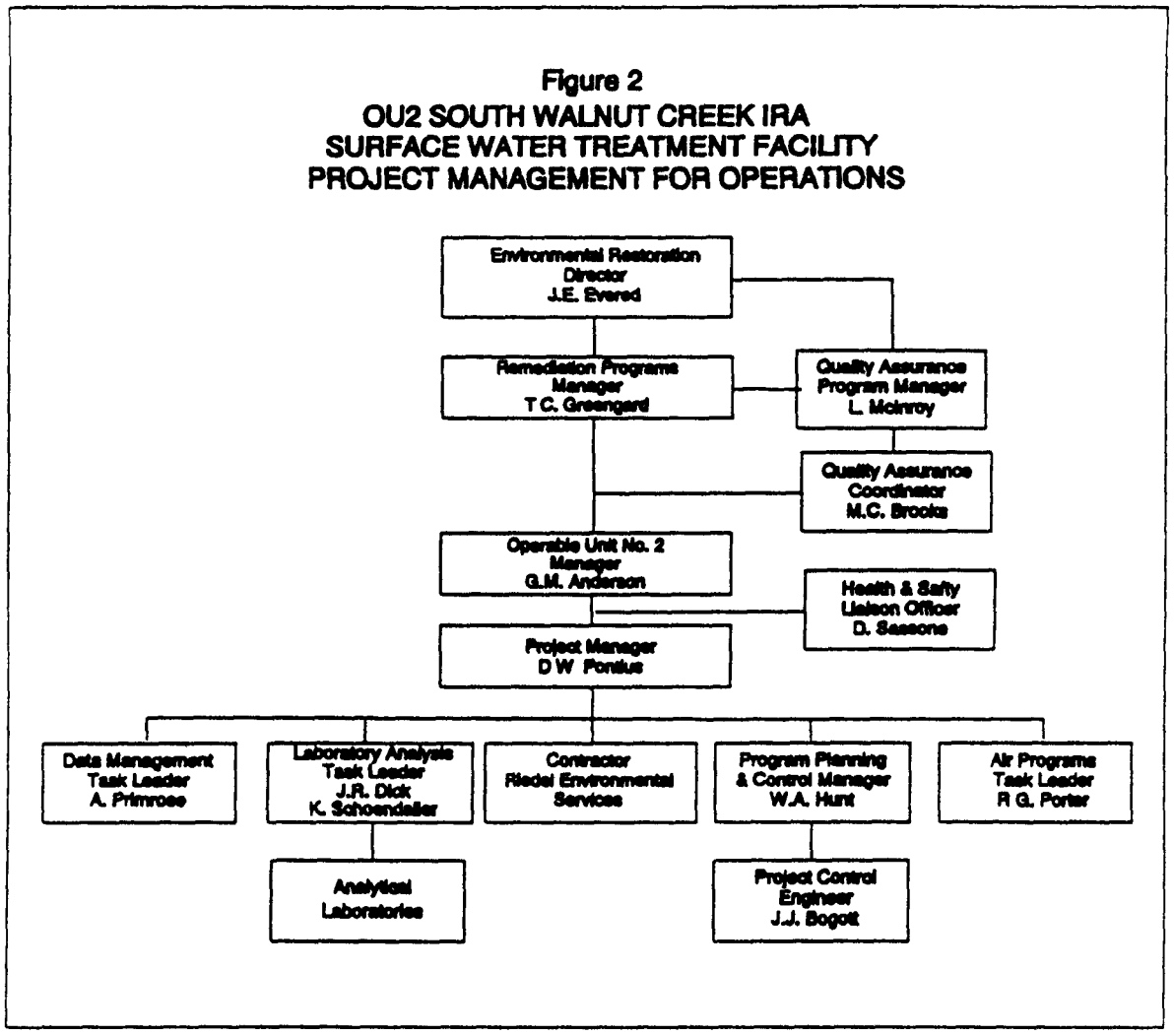


FIGURE 2 OU 2 IRA OPERATION MANAGEMENT SYSTEM



Construction Coordinator

The Construction Coordinator (CC) is assigned to the project by FPM and reports to the Facilities Project Manager All construction activities by the Contractor and its subcontractors will be conducted in accordance with EG&G approved engineering drawings and performance specifications Statements of Work Construction Work Procedures the QAPjP and this QAA The CC is a point of contact in the field for the contractor and its subcontractors The CC coordinates and/or schedules any required utility outages street closures plan access requirements provides technical inspections of completed work and obtains all necessary plan construction work permits The CC coordinates any required safety training of contractors and ensures work is conducted in accordance with all project safety regulations The CC ensures that radiological and industrial hygiene measurements are taken and coordinates these activities with the Radiation Protection Technologists and Industrial Hygienists The CC records all work progress and prepares punch lists and other reports on subcontractor performance The FE and FPM Manual outlines any other duties of the CC The CC has stop work authority if project construction health and safety or quality criteria are not met

Health and Safety Coordinator

The Health and Safety Coordinator (HSC) is assigned to the project by the Occupational Safety Manager and reports to the Project Manager The HSC is responsible for coordinating all health and safety related activities for the project including securing the services of Health Physicists Industrial Hygienists and Safety Engineers as necessary The HSC monitors the OU 2 Surface Water Treatment Facility requirements as outlined in the Contractor s OU 2 South Walnut Creek Surface Water Treatment Facility Site-Specific Health and Safety Plan The HSC monitors construction for personnel protection and industrial safety considerations conducts health and safety worksite inspections documents health and safety audits and reviews all health and safety related submittals prior to issuance The Contractor shall develop implement and monitor a site-specific health and safety plan

All EG&G employees subcontractors and their personnel who are assigned to this project are required to have all of the requisite training satisfying 29 CFR (Code of Federal Regulations) 1910 and 1926 The HSC or designees have stop work authority for all safety related criteria

A contractor (Riedel Environmental Services) has been tasked by EG&G Rocky Flats to construct and install the water treatment facility This contractor will report directly to the Project Manager and the CC as shown in Figure 1

2 0 QUALITY ASSURANCE PROGRAM

The QAPjP was written to specifically address QA controls for IAG related activities The content of the QAPjP was driven by DOE Rocky Flats Plant Standard Operating Procedure 5700 6B which requires that a QA program be implemented for all Rocky Flats Plant (RFP) activities based on American Society of Mechanical Engineers (ASME) NQA 1 Quality Assurance Requirements for Nuclear Facilities as well as the IAG which specifies that a QAPjP for IAG related activities be developed in accordance with EPA QAMS-005/80 Interim Guidelines and Specifications for Preparing QAPjPs The 18-element format of NQA 1 was selected as the basis for both the plan and subsequent addenda with the applicable elements of EPA QAMS 005/80 incorporated where appropriate

The QA controls and requirements addressed in the QAPjP are applicable to the OU 2 Surface Water Treatment Facility IRA activities unless otherwise specified in this QAA As a supplement to the QAPjP this QAA addresses additional and site specific QA controls and requirements that are applicable to the OU 2 IRA construction and installation activities

2 1 Training

All personnel performing activities in accordance with the Standard Operating Procedures (SOPs) specified in this QAA shall receive training as specified in the QAPjP the OU 2 South Walnut Creek Surface Water Treatment System PMP and the OU 2 South Walnut Creek Surface Water Treatment System Installation and Work Instructions

3 0 DESIGN CONTROL AND CONTROL OF SCIENTIFIC INVESTIGATIONS

The primary objective of this IRA is to determine the effectiveness of the GAC Water Treatment Facility to reduce contaminant levels in the surface water contributing to the flow in South Walnut Creek A secondary objective is to provide additional information regarding the characteristics of water that discharges from the Protected Area In order to meet these objectives the following activities will be performed

- Installation of surface water collection system and influent piping
- Installation and operation of a GAC water treatment facility
- Sampling and analysis of surface waters at several locations throughout the treatment process
- Sampling and analysis of the treatment system waste materials (e g sediments and used GAC material)

Design control and control of the IRA activities shall be accomplished as described in the QAPjP As stated previously this QAA is applicable only to the construction and installation of the GAC Water Treatment System Therefore the controls for scientific investigations including establishing Data Quality Objectives implementing quality control checks and data verification that are discussed in the QAPjP are not applicable here These controls for scientific investigations for this IRA activity will be presented in a separate operational QAA

3 1 Design Specifications

Specifications for the GAC treatment system have been provided in the following EG&G Rocky Flats Facilities Engineering Documents

- Specifications and Drawings for the Operable Unit No 2 Granular Activated Carbon Treatment System EG&G Rocky Flats Facilities Engineering Department Authorization #986447 October 1990

Addendum to Specifications and Drawings Dated October 19 1990 for Operable Unit No 2 Granular Activated Carbon Treatment System EG&G Rocky Flats Facilities Engineering Department Authorization #986447 December 6 1990

These two documents and any revisions and/or addenda to them shall provide the design control specifications for the design fabrication installation start up and performance for the treatment facility The treatment facility includes the temporary surface water collection system and the trailer containing the GAC treatment system

The installation and work instructions contained in the Installation and Work Instructions Manual for the Operable Unit No 2 South Walnut Creek IRA Surface Water Treatment Facility provide an outline of the instructions and controls for installation operation and maintenance of the treatment facility Those instructions will be supplemented by a more detailed Operations and Maintenance Manual for the South Walnut Creek GAC Treatment System to be developed by the construction and operating contractor and approved by EG&G

3 2 Equipment Decontamination

Any sampling equipment that may be used during installation of the GAC Water Treatment System at RFP shall be decontaminated in accordance with EG&G SOP 1 3 General Equipment Decontamination and/or SOP 1 4 Heavy Equipment Decontamination Decontamination residuals produced during facility installation will be handled according to SOP 1 7 Handling of Decontamination Water and Wash Water

4 0 PROCUREMENT DOCUMENT CONTROL

The GAC Treatment System construction and operating contractor (Riedel Environmental Services) will install and operate the system and conduct field sampling as described in the Agreement for Service contract between EG&G and Riedel Environmental Services Inc The contractor will be required to implement all applicable requirements contained in the QAPjP this QAA and the installation and work instructions

Contractors may be required to submit a QA Program that meets the applicable requirements of the QAPjP and this QAA

5 0 INSTRUCTIONS PROCEDURES AND DRAWINGS

The design control documents referenced in Section 2 of this QAA were developed reviewed and approved by EG&G according to the requirements of Section 5 0 of the QAPjP The installation instructions provided in the Installation and Work Instructions for OU 2 South Walnut Creek IRA Surface Water Treatment Facility will also be reviewed and approved by EG&G according to the requirements of Section 5 of the QAPjP Any changes or revisions to those specifications and instructions will be reviewed and approved by the originating organization

6 0 DOCUMENT CONTROL

The following documents will be controlled in accordance with the QAPjP

- Project Management Plan for OU 2 South Walnut Creek IRA Surface Water Treatment Facility 903 Pad Mound and East Trenches Areas
- Installation and Work Instructions for OU 2 South Walnut Creek IRA Surface Water Treatment Facility
  Quality Assurance Addendum (QAA 2 3) to the Site Wide QAPjP for OU 2 South Walnut Creek IRA Water Treatment Facility (Construction and Installation)
  Rocky Flats Plant Site Wide Quality Assurance Project Plan for CERCLA Remedial Investigation/Feasibility Study and RCRA Facility Investigation/Corrective Measures Study Activities (QAPjP)
- SOPs and construction and operating procedures specified in Table 1 of this QAA
  Site Specific Health and Safety Plan for OU 2 South Walnut Creek Granular Activated Carbon Treatment System

7 0 CONTROL OF PURCHASED ITEMS AND SERVICES

The contractor that will provide construction and installation services to support the South Walnut Creek Surface Water Treatment Facility activities has been selected and evaluated as outlined in the QAPjP Prior to delivery of the GAC Treatment Facility to the DOE RFP site the system will receive a Function Test The Function Test will be performed at the Riedel Environmental Services facility in Denver Colorado with clean water from RFP and will include a mock collection configuration (using a trough for collection weirs and tank) This test will display the system s general working order and ability to perform to basic standards The following items will be operated and inspected

- Trailer doors hinges latches etc
- Landing gears leveling jacks
- Lighting receptacles
- Process pump operation through high and low flow rates
- Plumbing valving flow circuits
- Pressure gauges flow sensors
- Safety valves check valves
- Drainage system
- Collection pump operation

EG&G representatives will be present and shall be notified of any problems encountered during this test The problems will be corrected by the contractor immediately and retested If the problem cannot be corrected immediately EG&G representatives will determine whether another test will be scheduled or if the problem component may be demonstrated during the Acceptance Test

Once installation of the system onsite at the RFP site is complete Riedel Environmental Services will perform an Acceptance Test to display and test the system s ability to perform to specifications This test will involve accumulation of contaminated water at SW 59 and SW 61 and transport to the tank Additional water collected from SW 132 will be treated at a later time Once ample amounts of water have been accumulated the process system will be started and

operated until 10 000 gallons of water have been successfully treated The system will be operated at maximum and minimum flow rates and the different flow configurations will be displayed

8 0 IDENTIFICATION AND CONTROL OF ITEMS SAMPLES AND DATA

The specifications for the construction and installation of the OU 2 South Walnut Creek IRA Surface Water Treatment System (i e the design control documents references in Section 3) contain the specification for the items parts and components for the treatment system Any incorrect or defective items that are noted during construction installation or inspections will be identified to preclude inadvertent use according to the requirements of Section 8 0 of the QAPjP

The requirements for the control of samples and data discussed in the QAPjP are not applicable to the construction and installation phase

9 0 CONTROL OF PROCESSES

The requirements for the control of processes are not applicable to the construction and installation of the OU 2 South Walnut Creek IRA Surface Water Treatment System

10 0 INSPECTION

Procured materials and construction activities shall be inspected (as applicable) in accordance with the requirements specified in Section 10 0 of the QAPjP the installation and operation specifications and the Installation and Work Instructions

11 0 TEST CONTROL

As described in Section 7 0 Function and Acceptance Tests will be performed on the water treatment system prior to initiating operations These tests will display the system s general work

condition and ability to perform per the specifications described in the design control documents referenced in Section 3 1

In addition to these tests all pipelines will be pressure tested during installation The length of pipe being tested will be isolated and pressurized then observed for loss of pressure Any leakage will be documented and corrected before installation of heat tracing and insulation

12 0 CONTROL OF MEASURING AND TEST EQUIPMENT

Pumps flow meters and pressure gauges that are used to test the system during the function and acceptance tests and pressure testing of the collection system s pipelines will be controlled adjusted and calibrated according to the manufacturers specifications

13 0 HANDLING STORAGE AND SHIPPING

The GAC Treatment System shall be transported to the site in a manner that will prevent damage to the system No specific transportation specifications regarding shipping of the system or its components have been established

14 0 STATUS OF INSPECTION TEST AND OPERATIONS

The requirements for the identification of inspection test and operating status of items products systems or equipment shall be implemented as specified in Section 14 0 of the QAPjP The status of the acceptance test and inspections will be documented

15 0 CONTROL OF NONCONFORMANCES

The requirements for the identification control evaluation and disposition of nonconforming items will be implemented as specified in Section 15 0 of the QAPjP Nonconformances identified by the construction and operating contractor shall be submitted to the Environmental Management (EM) Department Quality Assurance Program Manager (QAPM) (see Figure 1) for processing as outlined in the QAPjP

16 0 CORRECTIVE ACTION

The requirements for the identification documentation and verification of corrective actions for conditions adverse to quality will be implemented as outlined in Section 16 0 of the QAPjP Conditions adverse to quality identified by the implementing contractor shall be documented and submitted to the ER Department QAPM for processing as outlined in the QAPjP

17 0 QUALITY ASSURANCE RECORDS

All construction and installation records are considered QA records and shall be processed in accordance with the SOP 1 2 Field Document Control QA records to be generated during the construction and installation of the OU 2 South Walnut Creek IRA Surface Water Treatment System include but are not limited to

- Calibration Records
- QAPjP/QAA
- Audit/Surveillance/Inspection Reports
- Nonconformance Reports
- Corrective Action Documentation
- Procurement/Contracting Documentation
  Training/Qualification Records
- Inspection Records

All QA records generated during the planning construction operation and closure of the GAC treatment facility for OU 2 will be submitted to the ER Department Document Custodian for processing according to the ER Department QA records system described in Section 17 3 of the QAPjP

18 0 QUALITY VERIFICATION

The requirements for the verification of quality shall be implemented as specified in Section 18 0 of the QAPjP Audits of the contractor providing construction and installation services shall be performed as described in previous sections of this QAA

19 0 SOFTWARE CONTROL

The use of software for the construction and installation of the OU 2 South Walnut Creek IRA Surface Water Treatment System is not anticipated Therefore the software control requirements discussed in Section 19 0 of the QAPjP are not applicable

INSTALLATION AND WORK INSTRUCTIONS

OPERABLE UNIT NO 2
SOUTH WALNUT CREEK
INTERIM REMEDIAL ACTION
SURFACE WATER TREATMENT FACILITY

U S DEPARTMENT OF ENERGY
ROCKY FLATS PLANT
GOLDEN, COLORADO

ENVIRONMENTAL RESTORATION PROGRAM
ROCKY FLATS PLANT

REVISION 0
AUGUST 1991

856D0114 005

TITLE

Installation of Granular Activated Carbon Treatment System

Approved By

Manager Remediation Programs (Date) 9/12/91

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OU 2 01	Installation and Work Instruction for OU 2 South Walnut Creek IRA Surface Water Treatment Facility

1 0 PURPOSE

This installation instruction describes the installation of the Granular Activated Carbon (GAC) treatment system for the Operable Unit No 2 (OU 2) South Walnut Creek Interim Remedial Action (IRA) on the Rocky Flats Plant (RFP) An installation instruction summary that summarizes the steps listed in Section 4 0 and lists the appropriate reference document and prerequisites and cautions is provided as Attachment No 1

2 0 PREREQUISITES

2 1 The storage tank and trailer unit will be anchored on a pad designed and constructed by the Contractor Riedel Environmental Services Inc (RES)

2 2 A site specific Health and Safety Plan written by RES and approved by EG&G will be available prior to construction start up

2 3 Personnel performing construction activities within Individual Hazardous Substance Sites (IHSS) and operating the treatment system on this project must have the 40 hour OSHA Hazardous Waste training

2 4 Installation of the GAC units in the trailer will adhere to the performance specifications and approved drawings

2 5 All construction personnel must have completed 40 hour OSHA (SARA) training 24 hour OJT 8 hour supervisor training (for supervisors only) and any required updates In addition all personnel must have a baseline physical complying with 29 CFR 1910 120 All training and medical requirements are to be complied with as outlined in the site specific health and safety plan prepared by RES

2 6 Daily Safety and Plan-of the Day Meetings shall be held between the EG&G Construction Coordinator EG&G Project Manager and RES Project Manager or the respective designees Weekly progress meetings will also be held between EG&G Project Manager and the RES Project Manager or the respective designees

2 7 Any and all subcontractors utilized by RES shall be appraised of liability under the Interagency Agreement (IAG)

2 8 The following Contractor personnel are required as needed for construction and equipment installation activities

- field engineer
- health and safety technician
  construction foreman
- electrician
- plumber
- carpenter
- heavy equipment operator
- laborers

2 9 The following materials are required for construction and equipment installation activities

- electrical supplies
- plumbing supplies
- lumber
- telephone service supplies
- insulation materials
- aggregate

- berm materials
  concrete
- road base

2 10 The following documents are required for construction and equipment installation activities

- weekly work permit
- excavation permit
- confined space entry permit
- Contractor health and safety plan
- approved contractor construction schedule
- OSHA and orientation training records
- physical examination and approved respirator protection plan

2 11 The following safety equipment is required for construction and equipment installation activities

- hard hats
- safety shoes or protectors
- electrical safety gear
- eye/ear protection
- PPE (as needed)

2 12 An approved Contractor work schedule shall be itemized as a checklist for the Project Manager and Construction Coordinator reference This checklist shall include the work procedure description the necessary reference document and applicable prerequisite activities and safety precautions

3 0 SPECIFICATIONS

3 1 EG&G Facilities Engineering/Facilities Project Management (FE/FPM) Design Criteria Manual

3 2 Specifications and Drawings for the Operable Unit No 2 Granular Activated Carbon Treatment System EG&G Rocky Flats October 1990

3 3 Addendum to Specifications and Drawings dated October 19 1990 for Operable Unit No 2 Granular Activated Carbon Treatment System EG&G Rocky Flats December 6 1990

3 4 Rocky Flats Plant Electrical specifications

3 5 Rocky Flats Plant (RFP) Standard SC 106 Revision E Important Low Hazard Seismic Loading

3 6 GAC Treatment System Operations and Maintenance Manual (in progress)

4 0 PROCEDURES FOR INSTALLATION OF GAC SYSTEM

Note

The collection transport and treatment systems will be installed by the construction contractor without permanently disrupting the environment All components will be temporary such that the site may be returned to its original condition upon removal of the system

4 1 Weir Installation

4 1 1 Place the pre cast concrete weirs in a bed of sand/bentonite mixture Do not excavate If necessary place sandbags at the water/bentonite contact to provide long term protection from erosion

4 1 2 Place a stainless steel submersible pump (free standing) inside each weir

4 1 3 Bolt a steel box cover to the top of each weir to protect the pumps

4 2 Piping Assembly

4 2 1 Route all piping on the surface and double contain any lines that transport raw water to prevent the spread of contaminants should a leak in the primary piping occur

4 2 2 Connect the primary influent pipeline to the submersible pump using insert fittings

Note

This pipe will be inserted into the secondary pipe

4 2 3 Connect the secondary piping to the primary piping using rubber reducing fittings except at the collection weirs

4 2 4 Pressure check all pipelines during installation Isolate each length to be tested and pressurize with air to 50 psi Observe for pressure loss If pressure loss occurs report the leakage to the EG&G Construction Coordinator Correct the leakage and repeat pressure check until no pressure loss is observed This step will be observed by an onsite inspector

4 2 5 Heat trace insulate and cover the pipelines with an aluminum skin secured with screws Support the insulated piping above ground with timber cribbing and anchor with tee posts

4 2 6 Route the discharge pipeline through the culvert Raise the pipelines from the bottom of the culvert with short lengths of channel stock placed laterally across the culvert

Note

The discharge pipeline will be constructed of schedule 80 PVC

4 2 7 Route the PVC discharge effluent piping to carry the treated water back to a point downstream from SW132

4 3 Pad Construction

4 3 1 Construct trailer and tank pads by spreading and compacting road base

4 3 2 Test the compaction of road base material by ATEC

4 3 3 Install pre fabricated trailer pad footings

4 4 Tank Assembly

4 4 1 Center a surge tank on the pad constructed by RES and anchor in accordance with Rocky Flats Plant (RFP) Standard SC 106 Rev E for Important Low Hazard Seismic Loading

Note

The surge tank will be placed inside a larger containment tank which is capable of retaining 120 percent of the surge tank s capacity Collection pump shutdown controls for overflow protection will be provided

4 4 2 Assure the tank is completely closed and the vent is fitted with a float valve that will close should the shutdown controls fail

4 5 Trailer Setup

4 5 1 Deliver pre fabricated 48 foot trailer to RFP

4 5 2 Center the trailer which will house the GAC Treatment System on the pad constructed by RES

4 5 3 Independently level the long and short sides of the trailer with 4 foot carpenter's levels

4 5 4 Connect cables from the trailer to helical anchors Tighten the tie downs in accordance with RFP Standard SC 106 Rev E for Important Low Hazard Seismic Loading

4 6 Seismic Loading

4 6 1 Install a skid mounted portable generator near the trailer and connect a 500 gallon double-wall steel fuel tank to the fuel supply

4 6 2 Plumb the trailer and the collection and discharge pipelines to the surge tank and to the respective submersible pumps and heat trace insulate and jacket the weirs and all remaining piping

4 6 3 Wire the collection pumps and heat tracing to the trailer breaker panel

4 6 4 Wire the breaker panel to the generator

4 7 Prepare System for Operation

4 7 1 Connect the inlet and outlet piping to their respective ports in the treatment system with quick connect hoses

4 7 2 Pre wet the GAC units prior to operation per the manufacturer s recommended methods (see GAC Treatment System Operation and Maintenance Manual)

4 8 Finalization/Acceptance Test

4 8 1 Perform a visual inspection of the Water Treatment System

4 8 2 Conduct the onsite acceptance test Once the GAC system is connected to the collection system an Acceptance Test of the entire treatment system will be conducted according to the specifications described in the Statement

of Work for the Operable Unit No 2 Granular Activated Carbon Treatment System and the Quality Assurance Addendum for the OU 2 South Walnut Creek Surface Water Treatment Facility An EG&G inspector will observe this Acceptance Test and initial the checklist (Attachment No 1) if the test meets specifications

4 8 3 Prepare punchlist and clean up the site

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RIEDEL ENVIRONMENTAL SERVICES
SITE SPECIFIC SAFETY PLAN
OPERABLE UNIT NO 2
GRANULAR ACTIVATED CARBON (GAC) TREATMENT SYSTEM
ROCKY FLATS PLANT
GOLDEN, COLORADO

April 25, 1991

1 0 INTRODUCTION

This plan establishes requirements and provides guidelines for worker safety and hazard identification during the installation of the Granular Activated Treatment System for the Operable Unit No 2 located at the Rocky Flats Plant in Golden Colorado The purpose of this plan is to identify procedures for avoiding potential hazards from chemicals equipment, or the environment, and for responding to serious injury or accident No changes will be made to this plan without consent and approval by RES project manager and health and safety officer These changes to be filed on HSP Field Change Forms in appendix A

1 1 SITE DESCRIPTION

The OU2 is comprised of the 903 Pad, Mound, and East Trenches Areas which are located east-southeast of the RFP as shown in Figure 1 The areas of OU2 lie within either the South Walnut Creek or Woman Creek drainage basins Twenty sites, designated as IHSSs, lie within OU2 five in the 903 Pad area, four in the Mound area, and 11 in the East Trenches area RES will install a water treatment system in this area but will not cross any IHSS sites

The 903 Pad Area consists of the following IHSS sites

1) 903 Drum Storage Site (#112) - Area used (during the 1950's and 1960's) for storage of drums containing cutting oils containing the following
   - Uranium
   - mineral oil
   - Carbon Tetrachloride
   - Trichloroethene
   - Tetrachloroethene
   - Silicone Oils
   - Acetone
   - Ethanolamine

   These drums were removed by 1968, the contaminated areas (resulting from leaking drums) were scraped into one area and capped with dirt and asphalt

2) 903 Lip Site (#155) - Area contaminated by wind carried contaminants from the pad area

3) Trench T-2 Site (#109) - Trenches used for disposal of sanitary sewage sludge and flattened uranium and plutonium contaminated drums

4) Reactive Metal Destruction Site (#140) - Area previously used for destruction of lithium sodium, calcium and magnesium metals and various organic solvents

5) Gas Detoxification Site (#183) - Building 952 - used to detoxify bottled gases

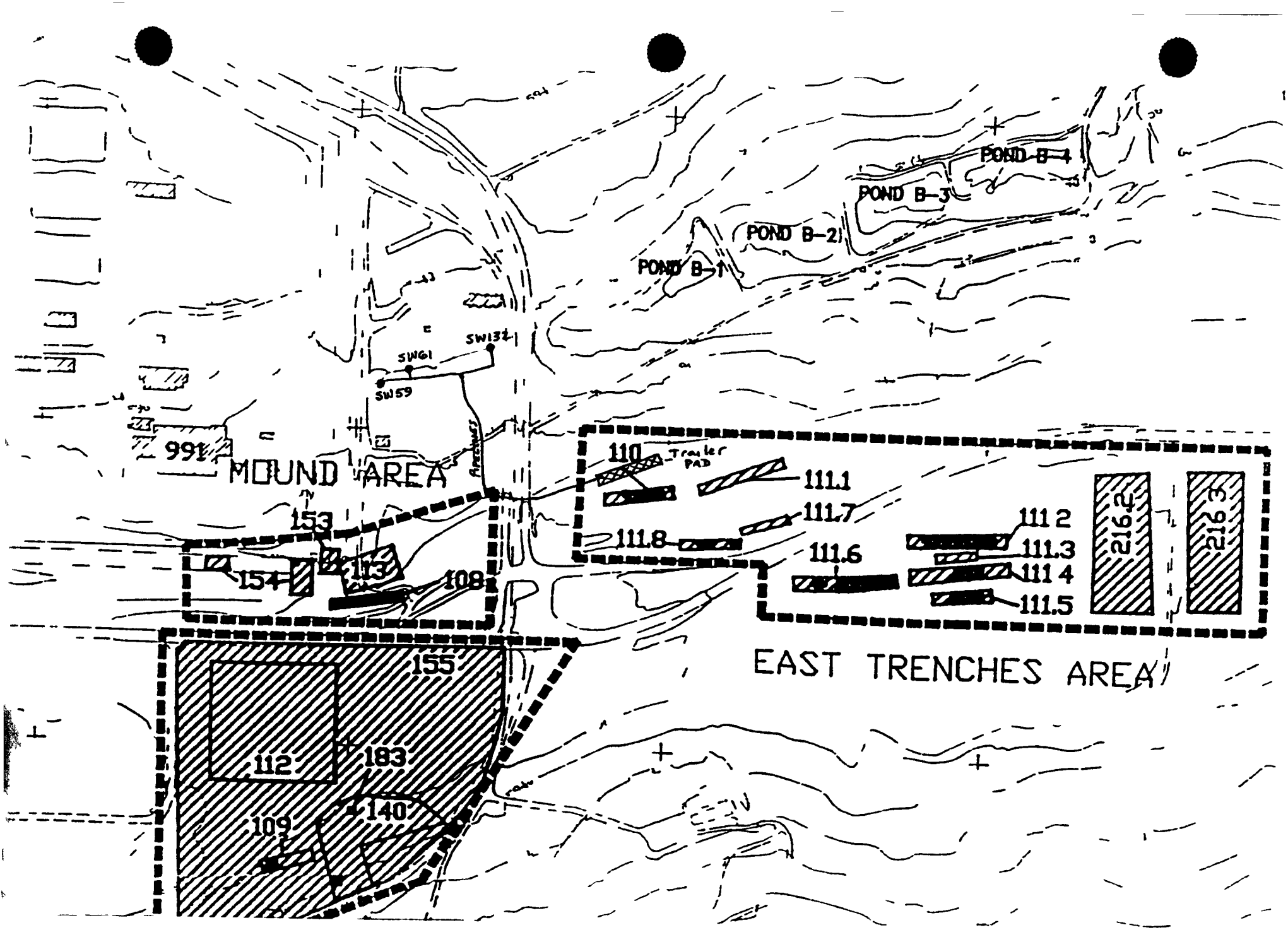

FIGURE 1 - IHSS LOCATIONS

The Mound Area consists of the following IHSS sites

1) Mound Site (#113) - Uranium, plutonium and solvent drum storage area Area has been partially remediated

2) Trench T-1 Site (#108) - Trench containing approximately 125 buried drums of depleted uranium and plutonium chips coated with lathe coolant

3) Oil Burn Pit No 2 Site (#153) - 2 trenches previously used for burning oil containing uranium

4) Pallet Burn Site (#154) - Area used to burn pallets which might have been contaminated with solvent and/or radionucleides

The East Trenches Area consists of 9 trenches which were previously used to dispose of depleted uranium, flattened depleted uranium and plutonium-contaminated drums and sanitary sludge These may be found in figure 1 as follows

Trench T-3 - #110
Trench T-4 - #111 1
Trench T-5 - #111 2
Trench T-6 - #111 3
Trench T-7 - #111 4
Trench T-8 - #111 5
Trench T-9 - #111 6
Trench T-10 - #111 7
Trench T-11 - #111 8

Additionally, two (2) areas (#216 2 and #216 3) were used for spray irrigation of sewage treatment plant effluent

Also present in the vicinity of the OU2 are six (6) other IHSS previously designated as Solid Waste Management Units (SWMU) (see Figure 1)

1) IHSS 121 Original Process Waste Lines - These are abandoned process effluent from the process areas at the facility Potential groundwater contaminants are tetrachloroethylene, trichloroethylene, carbon tetrachloride radionuclides and nitrates

2) IHSS 141 Sludge Dispersal Plume - This area is believed to have been impacted by wind dispersion of dried sludge from the Sewage Treatment Plant drying beds

3) IHSS 142 5 Retention Pond B-1 - This pond was believed to have been contaminated by various wastes containing nitrates and low level radioactive waste

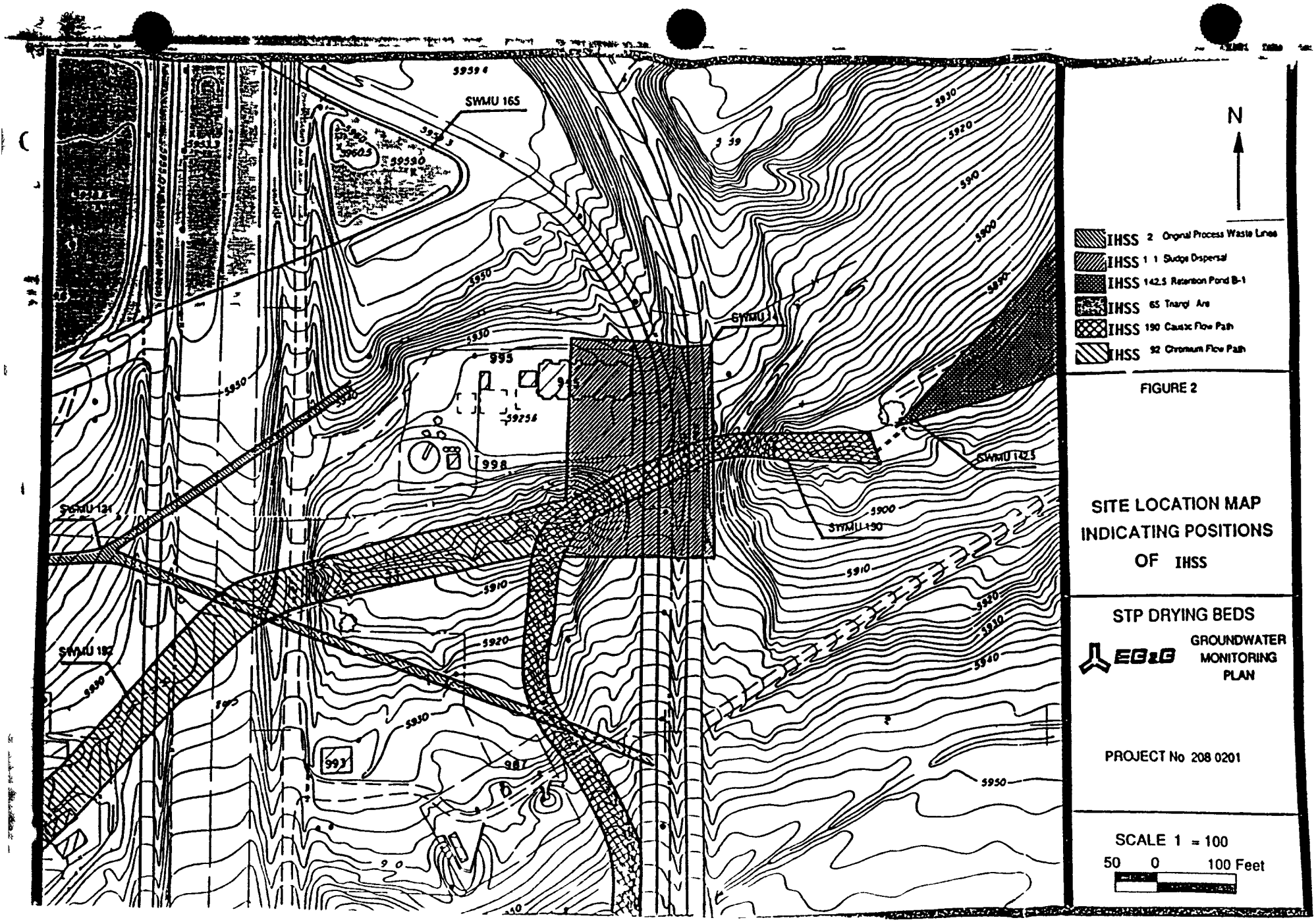

FIGURE 2 - IHSS LOCATIONS (PREVIOUSLY SWMU)

4) IHSS 165 Triangle Area - This area was used from 1966 to 1975 for the storage of drums containing plutonium-contaminated wastes These wastes have since been removed

5) IHSS 190 Caustic Flow Path - This area was caused by a spill of caustic wastes near the steam plant (building 443) Snowmelt is believed to have transported potassium hydroxide (which had been neutralized) to Pond B-1

6) IHSS 192 Chromium Flow Path - This area was caused by the transport of cooling-tower blowdown, which may have contained chromium-laden biocides, to Pond B-1

RES will install water collection stations at SW59 and SW61 which are located in IHSS 192 Chromium Flow Path (see figures 2 and 3), no excavation will take place

Chemical Data Sheets for the various contaminants present may be found in Appendix C

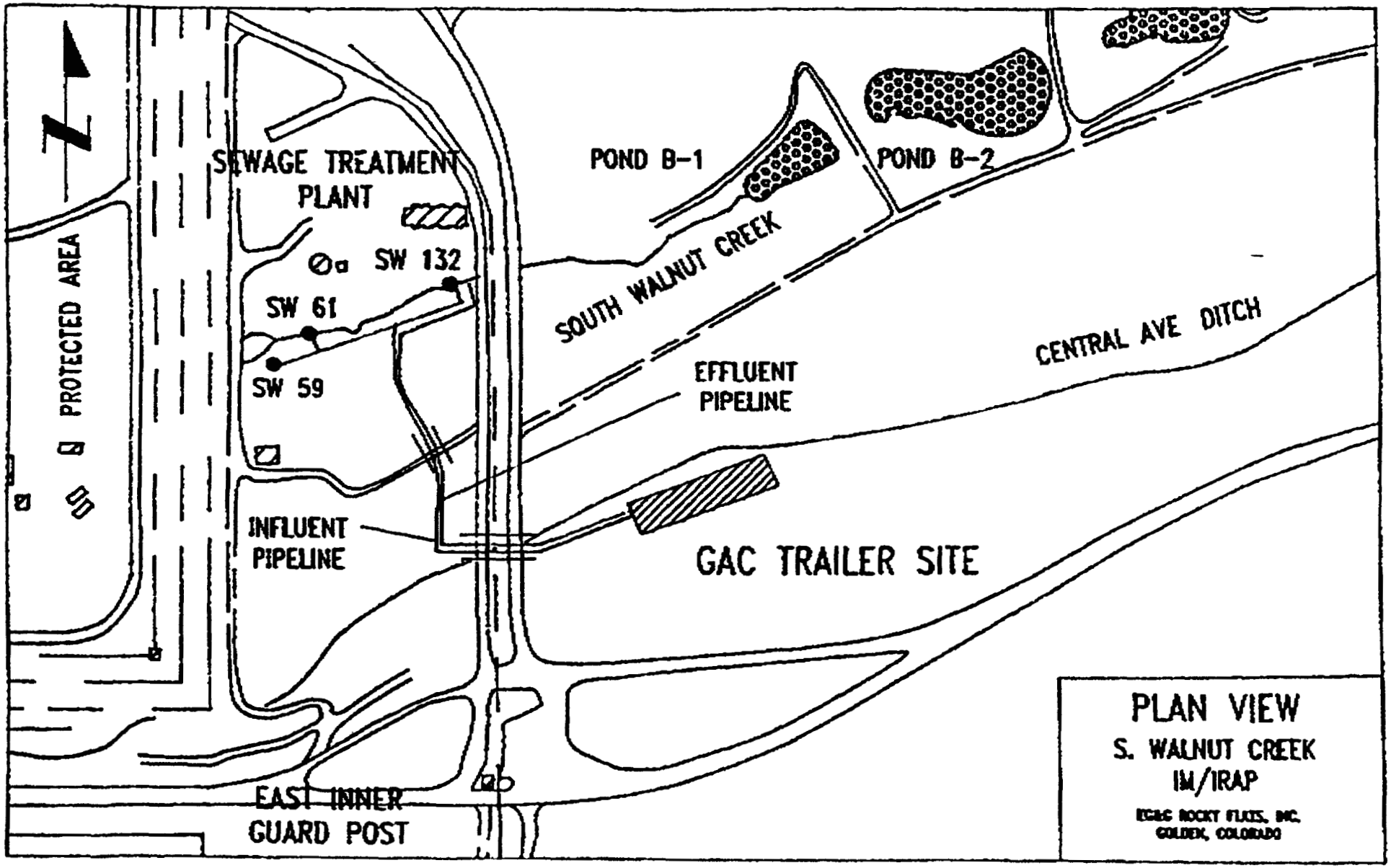

FIGURE 3 - GAC TREATMENT SYSTEM LOCATION

2 0 SCOPE OF WORK

As part of the Interim Remedial Action Plan for the Operable Unit Number 2, RES will design, build and set up at Rocky Flats a water filtration system which includes the following

1) Collection System - catch basins in the field to collect water and pump it to storage tank,
2) Process System - three bag filters and four granular activated carbon (GAC) units to filter water of assorted hydrocarbons and chlorohydrocarbons
3) Trailer - housing for process system and office,
4) Electrical System - support for alarms, process system, collection system and trailer

These will be fabricated and installed during April and May, 1991 (see figure 3 for location and layout)

3 0 KEY PERSONNEL ASSIGNMENTS

3 1 EG&G PERSONNEL

NAME	TITLE	EXTENSION
J E Evered	E R Director	4934
T C Greengard	Remediation Programs Manager	7121
D W Pontius	IRA Manager	5536
D Smith	E R H&S Officer	5958
J R Majestic	H&S Director, Deputy AGM	4707
F J Furman	Occupational Health Director	2895
C E Kennedy	Manager, Safety & Hygene	4369
G Shearer	H&S Area Manager	2755
D M Sassong	H&S Liason Officer	5785
L A Doerr	Radiation Engineering Rep	5151
B P Fielding	Site H&S Coordinator	7098

3 2 RES PERSONNEL

NAME	TITLE
Matt Wetzel	Project Manager
Gerald Marks	H&S Officer
David McClellan	Project Engineer
Frank Johnston	Project Foreman

The Project Manager will have overall responsibility for implementation of the site health and safety program

The Health and Safety Officer will be responsible for application of the site health and safety plan to each task

The Project Engineer will be responsible for the design and installation of the treatment system

The Project Foreman will be responsible for on-site personnel assignments and task completion

4 0 ONSITE WORKPLANS

The following tasks will be completed on RFP site for the installation of the OU2 system These tasks will overlap, somewhat, but the sequence will be similar to the following

1 Each weir will be installed without excavation (see QA Addendum) A steel box cover will be bolted to the tops of each weir to protect and contain the weir A stainless steel submersible pump will be placed (free standing) inside

2 The primary influent piping will be connected by using insert fittings This pipe will be inserted into the secondary pipe, which is also connected using insert fittings All secondary piping will be connected to the primary using rubber reducing fittings (except at the collection weirs) The system will periodically be pressure checked for leakage The discharge pipeline will be constructed of schedule 80 PVC and pressure checked Routing through the culvert will require cribbing with short lengths of channel stock placed laterally across the culvert to raise the pipelines from the bottom

3 The pipelines will be heat traced, insulated, and covered with an aluminum skin secured by screws The insulated piping will be supported above the ground with timber cribbing where necessary and anchored with tee posts

4 The surge tank will be placed inside the containment tank and will be plumbed together The tank will be centered on the pad and anchored in accordance with Rocky Flats Plant Standard SC-106 Rev E for Important-Low Hazard Seismic Loading

5 The trailer will be delivered and centered on a pad built by RES The long and short sides of the trailer will be leveled independently, using 4 foot carpenters levels Cables will be connected from the trailer to the tie-downs provided by EG&G, these will be tightened in accordance with Rocky Flats Plant Standard SC-106, Rev E for Important-Low Hazard Seismic Loading

6 The portable generator will be placed near the trailer and connected to its fuel supply (a 500 gallon double wall steel fuel tank) The fuel tank will be properly grounded, placement and installation of the tank will be inspected for approval by EG&G Fire Department

7 The trailer will be plumbed to the surge tank The collection and discharge pipelines will be plumbed to the surge tank and their respective submersible pumps

8 The weirs, and all remaining piping will be heat traced insulated and jacketed

9 The electrician will wire the collection pumps, and heat tracing to the trailer's breaker panel The breaker panel will be wired to the generator

10 Final system inspection and check

11 Acceptance test

5 0 HAZARD EVALUATION

Installation of the OU2 GAC system will present the following potential hazards

1) Physio-chemical - Various organic contaminants (see Table 1) exist in the water at SW59 and SW61 in low concentration, it is anticipated that these contaminants will not pose a respiratory threat to workers, however, precautions will be taken to avoid physical contact with these waters
2) Biological Hazards - Bee sting and snakebite may pose a threat to workers on this site
3) Radiological - Low level may be present in surrounding areas (25 pCi/gm Alpha and 36 pCi/gm Beta have been detected in the siols in the area) and in the water at SW59 and SW61(Table 1), the immediate site will be sampled by EG&G prior to work to ensure that significant levels of radionuclides are not present
4) Construction - typical hazards will include electrical shock, vehicular hazards, crane, and typical hand tool hazards

5 1 SITE SPECIFIC HAZARDS

1 Low Level Radiation
This project does not involve handling of significantly high levels of radioactive material, but the potential to encounter radioactive materials exists from currently unknown sources Any suspect material (i e does not belong to RES) should be treated with the likelihood of containing radioactive material and should not be handled without written authorization from EG&G Additionally, any restricted areas should not be entered for any reason without proper authorization from EG&G These restricted areas will be posted with proper labeling and barricaded Items which display yellow media are to be considered containing radioactive materials and should not be handled by RES personnel EG&G will provide TLD Badges for Riedels' personnel to be analyzed monthly as required by EG&G protocol Riedel employee's will sign a statement for EG&G to release results of TLD Badges to Riedel In addition EG&G personnel will make a daily sweep of the area for low level radiation during installation

2 IHSS/SWMU
This phase of RES operations is not within IHSS areas No SWMUs comprise the selected trailer site but the collection stations will be placed on a SWMU area, the soil in this area will not be removed RES personnel is directed not to enter or disturb soil within IHSS/SWMU boundaries

TABLE 1

SURFACE WATER QUALITY

	UNITS	INFLUENT CONCENTRATION	EFFLUENT CONCENTRATION
Organics			
Vinyl Chloride	ug/l	11	NA
Methylene Chloride	ug/l	34	NA
Acetone	ug/l	99	NA
Carbon Disulfide	ug/l	5	5U
1 1 Dichloroethene	ug/l	127	5U
1 1 Dichloroethane	ug/l	6	5U
1 2 Dichloroethene	ug/l	10	5U
Carbon Tetrachloride	ug/l	249	5U
Trichloroethene	ug/l	298	5U
Tetrachloroethene	ug/l	235	5U
Dissolved Metals			
Antimony	mg/l	0 0607	NA
Beryllium	mg/l	0 0052	NA
Iron	mg/l	0 3476	NA
Manganese	mg/l	0 6073	NA
Selenium	mg/l	0 0063	NA
Strontium	mg/l	0 8772	NA
Tin	mg/l	0 7641	NA
Total Metals			
Aluminum	mg/l	24 0745	NA
Antimony	mg/l	0 645	NA
Barium	mg/l	1 5985	NA
Beryllium	mg/l	0 0439	NA
Cadmium	mg/l	0 0120	NA
Chromium	mg/l	0 1642	NA
Cobalt	mg/l	0 1105	NA
Copper	mg/l	0 2281	NA
Iron	mg/l	155 5478	NA
Lead	mg/l	0 1664	NA
Lithium	mg/l	0 5859	NA
Manganese	mg/l	2 8410	NA
Mercury	mg/l	0 0019	NA
Molybdenum	mg/l	0 1426	NA
Nickel	mg/l	0 1922	NA
Selenium	mg/l	0 0078	NA
Strontium	mg/l	0 9081	NA
Tin	mg/l	0 1941	NA
Vanadium	mg/l	0 4244	NA
Zinc	mg/l	1 3159	NA

TABLE 1 (cont)

SURFACE WATER QUALITY

	UNITS	INFLUENT CONCENTRATION	EFFLUENT CONCENTRATION
Dissolved Radionuclides			
Gross Alpha	pCi/l	17 70	NA
Gross Beta	pCi/l	33 86	NA
Plutonium 239/240	pCi/l	0 17	NA
Total Uranium	pCi/l	10 17	NA
Total Radionuclides			
Gross Alpha	pCi/l	632	NA
Gross Beta	pCi/l	463	NA
Plutonium 239/240	pCi/l	7 34	NA
Americium 241	pCi/l	2 96	NA
Total Uranium	pCi/l	13 21	NA

The influent concentrations are based on flow weighted maximum concentrations of 903 Pad and Lip Area Seeps (SW 50 51 52 55 57 58 and 77) SW 53 59 63 64 and Upper South Walnut Creek seeps and surface water stations (SW 56 60 61 101)

The effluent concentration requirements are based upon Applicable or Relevant and Appropriate Requirements (ARARs) The U designation following the effluent concentrations indicates that the concentration is the detection limit for that constituent

3 Noise
Elevated noise levels may be encountered during filter changes from the purging of air from the vessels A noise survey will be conducted by RES when the operation begins to determine the need for hearing protectors Control of noise hazards shall be in accordance with 29 CFR 1910 95 Noise hazard areas (greater than 85 decibel average continuous, or 140 decibel impulse) must be appropriately marked and hearing protection for noise attenuation worn when in the area

4 Electrical Shock
Electricity is provided for operations by EG&G The filtration system will be properly grounded, with outlets protected with ground fault interrupters All electrical cords will be rated for the task involved, and will be inspected prior to use to insure good working condition

5 Vehicles
On site speed limits have been established at 5 mph Site characteristics has developed numerous short visibility areas, blind spots and a need to reduce dust disturbance (IHSS/SWMU) which requires slow speeds Seat belts will be worn by all workers in vehicles

6 Granular Activated Carbon (GAC)
GAC preferentially removes oxygen from air Warning signs will be provided to indicate the potential for a low-oxygen area Warning signs will also be provided indicating that the access doors to the trailer remain open while servicing the GAC units

7 Heat - Ambient Air
During summer months temperatures will range from 70°F to 95°F Crews will maintain proper fluid intake, break in shady areas, and observe each other for signs of 'Heat Stress ' Hazards and symptoms of heat stress will be discussed in tailgate safety meetings when necessary

8 Cold - During winter months temperatures could range from 40°F and below Crews will watch each other for signs of cold stress Warm fluids and frequent breaks may be deemed necessary Hazards and symptoms of cold stress will be discussed in tailgate safety meetings when necessary

9 Rain - Spring and Summer rains will make for slick surfaces and an increase in volumes of water to treat

10 Snow - Winter snows will make for slick surfaces, reduced visibility and possible ground blizzard

11 Electric Storms - During electric storms crews will remain indoors or in a vehicle until it passes All equipment shall be properly secured and grounded

12 Lifting/Moving - Proper techniques for lifting shall be used when changing filters Mechanical devices shall be used whenever possible

13 Rough Terrain - Rocky Flats Plant is located near the foothills so terrain has hills, valleys, slopes, ditches etc Crews shall pay attention while on foot or off road in a vehicle

14 Structural Integrity -The trailer should be an enclosed, self contained unit, stable and will be anchored in accordance with Rocky Flats Low Importance Siesmic Criterion and for high wind stability

15 Remote Area - Areas of Rocky Flats Plant are isolated and have poor visibility Crews will have a portable phone or radio contact with one another and with RFP Emergency Response (966-2911)

16 Heavy Equipment - Some heavy equipment will be used to move the trailer and plow roads All equipment shall have roll cages and seat belts Back up alarms shall be on all pieces of equipment

17 Materials Handling - All materials shall remain in original containers if possible Proper storage and usage shall be followed

18 Storage Flammable Gas/Liquid
Diesel fuel shall remain in proper D O T approved container or in fuel tank on Riedel pickup or in properly grounded double wall storage tank All other fuels will be stored in approved safety cans in approved locations

19 HazMat Use/Corrosives
Acids used to treat samples shall remain in original container and handled using safe work practices as discussed in RES 29 CFR1910 120 training for hazardous waste site worker awareness Nitrile or Neoprene gloves will be worn when handling corrosives MSDS's will be provided on-site for all chemical products supplied or used on-site by RES

20 Hand Tools - Hand tools will be inspected weekly and before each use for wear, jagged edges, split or broken handles and removed from service if defects are found All manufacturers procedures shall be followed

21 Power Hand Tools - Power tools shall be inspected weekly and before each use Any defects the tool is to be pulled from service and tagged for repairs All manufacture's procedures shall be followed

22 High Pressure Water - Water will be flowing thru pipe and hose at maximum 50 psi Connections and clamps are to be inspected daily Spare fittings and hoses will be kept on site should there be a rupture Additionally, the system will be equipped with pressure controls and relief (and backup pressure relief) to protect against overpressurization All exterior piping in doubly contained, all interior piping is contained in a bermed area, the equalization tank is contained in a secondary tank Should a problem arise, any spillage will be contained within the secondary piping, tank or within the containment berm, the spillage will be directed to the tank for treatment for discharge

23 Wind - Rocky Flats being along the front range catches numerous days of high winds All equipment, trailers, and pumps shall be anchored as not to be effected by the wind In excessive wind employees shall remain in an anchored trailer or vehicle During construction, winds in excess of 15mph the job will shut down

24 Confined Space Entry - Installation of the pipelines within the culvert under the buffer zone access road will require entry All procedures will closely follow and comply with RES' and EG&G's confined space entry program (See Appendix B)

25 Lift Equipment - Installation of the System will require use of a small crane to off load and locate equipment

26 Ladders - Ladders may be used periodically to inspect the tank and trailer The ladder will be secured at top and bottom for slide out and safety harnesses with lifelines attached to the top of the tank will be used when working on the tank

5 2 ENGINEERING CONTROLS

The engineering controls built into the water treatment system to minimize risk of exposure include

1 Closed system from weirs to discharge

2 Pressure relief valve to shunt excess water to storage tank at pressure in excess of 12 psig

3 Air auto-release valve for each GAC unit

4 Cleanup pump on floor under GAC units

5 Heat, ventilation and air-conditioning unit in the trailer

6 PVC piping to withstand pressure in excess of 100 psi

7 Visual and audible alarm system for overflow or low volume

8 Backflush and drain GAC units immediately with water prior to removal

9 All water will be returned to the equalization tank for treatment for discharge

A deluge shower will be built in the front of the trailer Workers will be instructed to remove clothing immediately and flush any body part that comes in contact with the contaminated water The shower is a pressure vessel with built in eye wash and drench hose It will contain solution and be pressurized to not over 90 PSI

5 3 SAFE WORK PRACTICES

Safe work practices by workers to minimize risk of exposure to contaminants include

1 Familiarity with hazards, symptoms of exposure and first aid for chemical contaminants present in filtration water, via on-site training

2 Wear PPE of PVC boots, saranex suit, nitrile gloves and face splash protection when performing work expected to encounter contaminated water such as sampling, filter changes, system repair/maintenance

Although contact with contaminated water is not anticipated, workers will be informed of the hazards of the contaminants in compliance with 29 CFR 1910 1200 and 1910 120 MSDS' will be kept on site as Appendix C to this site safety plan

6 0 GENERAL TRAINING

All personnel who work on this site will complete 40 hours of classroom training in handling hazardous waste (O S H A 1910 120) This training includes

Regulatory Compliance (OSHA, EPA, DOT)
Toxicology
Flammables
Corrosives and Reactives
Respiratory Protection
Protective Clothing
Noise Stress
Heat/Cold Stress
Ionizing Radiation
Drum Handling
Confined Space
Decontamination
Environmental Monitoring
Site Safety Plans
Medical Surveillance
Contingency Plans

The classroom training is followed by three days of on-the-job training, supervised by experienced personnel Annually all field employees receive eight hours of refresher training on the above topics

Additionally, all on-site personnel involved with the operation of the system will complete a radiation worker training provided by EG&G

Managers and supervisors receive eight hours of training on safe management of hazardous sites All training complies with 29 CFR 1910 120 All RES field employees receive initial and recertification training in First Aid and CPR Site specific training for this project includes a 24 hour class put on by EG&G in Radiation Safety and operations

6 1 TRAINING FOR SITE SPECIFIC HAZARDS

All employees who are subject to exposure to the organics, dissolved metals and total metals of the filtered water shall be informed of the following

Specific nature of the operations which could result in exposure to contaminants

The purpose, proper selection, fitting, use and limitations of protective equipment applicable to work with contaminated water

A description of the medical surveillance program to evaluate for effects of exposure

Information concerning the symptoms and adverse health effects associated with exposure to the contaminants

Routes of exposure (skin penetration, inhalation, and ingestion)

First Aid for exposure to the contaminants

6 2 TAILGATE SAFETY MEETINGS

Job site tailgate safety meetings shall be conducted by the RES health and safety officer or the shift foreman at the beginning of each shift for each job and whenever new employees arrive at the job site The meetings discuss the Health and Safety considerations for that day's activities and outline the protective equipment necessary Minutes of the meetings will be maintained Weekly safety meetings will be conducted by the Project Manager with the aid of one crew member from each shift discussing a site specific topic of concern

7 0 SITE CONTROL

Access to the site will be controlled by Riedel with assistance from the EG&G security staff Only qualified individuals may enter the site and perform work on the project, and will require understanding of this Site Safety Plan (as indicated by signature on the safety plan) The site is visible from the inner east gate and proper signs will designate areas for safe entry

Zones will be established as defined by the tasks and PPE requirements outlined in section 8 0 of this plan, details reguarding locations of these zones will be discussed in the toolbox safety meeting prior to work requiring regulated zone establishment The zones will include an exclusion zone, contamination reduction zone and support zone designated by differing colored banner guard

8 0 PERSONNEL PROTECTIVE EQUIPEMENT

At all times, all workers on site will wear steel-toe shoes and hard hats When performing tasks presenting a risk for exposure to contaminants, workers will wear modified level "D" protection (SEE Table 2) This will include

Hard Hats
Steel-Toe PVC Shoes
Shatter resistant eye goggles or face shield
Nitrile Gloves
Saranex Suit

No changes to the specified levels of protection shall be made without the approval of the site safety offices and/or the project manager

Contaminated protective equipment shall not be removed from the regulated area until it has been decontaminated or properly secured for decontamination elsewhere

Legible and understandable precautionary labels shall be affixed prominently to containers of contaminated scrap, debris, waste water and clothing prior to storage on site

No food or beverage shall be present or consumed in the designated regulated zones Eating or drinking shall be allowed only in designated areas and only after hand and exposed skin has been washed

No tobacco products shall be present or used in regulated zones Cosmetics shall not be applied in the regulated zones

All work on the project will be conducted according to the "Buddy" system

TASK / HAZARD	MOD LEVEL D REQ D	Low Level RAD	IHSS/SWMU	Noise	Electrical Shock	Vehicles	GAC	Heat	Cold	Rain	Snow	Electric Storm	Lifting/Moving	Rough Terrain	Structural Integrity	Remote Area	Heavy Equipment	Materials Handling	Storage Flammable Liquid	Hazmat Use	Hand Tools	Power Tools	High Pressure Water	Wind	Confined Space	Lift Equipment	Ladders
WEIR INSTALLATION	*	*	x	x	x	x		x	x	x	x		x	x	x	x	x											
PIPELINES	*	*	x	x	x	x		x	x	x	x		x	x	x	x	x											
HEAT TRACE/INSUL	*		x		x	x		x	x	x	x		x	x	x	x	x											
TANK INSTALLATION				x		x		x	x	x	x		x	x	x	x	x											
TRAILER SETUP						x	x	x	x	x	x	x	x		x	x	x											
GEN SET INSTALL				x	x	x		x	x	x	x	x	x		x	x	x		x	x								
TRAILER HOOKUP					x	x	x		x	x	x	x	x			x	x		x	x								
WEIR INSULLATION	*					x		x	x	x	x		x	x		x	x			x								
FINAL WIRING					x	x			x	x	x		x			x	x			x								
ACCEPTANCE TEST	*	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		x								

TABLE 2

TASK/HAZARD RELATIONSHIP
WITH PPE REQUIREMENTS

MEDICAL SURVEILLANCE INFORMATION SHEET

EMPLOYEE NAME _____ TITLE _____ SSN _____

Operable Unit _____ Phase _____

Describe the employee s duties as they relate to the exposures at the ER remedial project site:

_____

_____

_____

_____

Detail the estimated exposure levels anticipated for this employee at this ER remedial project site:

_____

_____

_____

_____

Describe the Personal Protective Equipment (PPE) that this employee is anticipated using at this ER remedial project site

_____

_____

_____

_____

FIGURE A-3 Medical Surveillance Information Sheet

HAZARDOUS MATERIAL ACCESS LOG

Date _____ Operable Unit Number _____ Phase Number _____

List the hazardous materials present in the work area and the concentrations (if available)

_____

_____

_____

_____

Names of employees entering area	Time of each entry	Time of each exit	Enter the coded numbers from below	
			Work Activities Performed	Personal Protective Equipment Used

WORK ACTIVITIES

1 Soil sampling placing dirt in containers
2 Augering drilling radiologic measurements
3 Walking cross standing on or near contaminated areas
4 Examining excavations
Water sampling
5 Monitoring removal of contaminated material
7 Other
8 Other
9 Other

PROTECTIVE EQUIPMENT

A 1 Safety Boots A 2 Outer Boot Coverings
B-1 Permeable Coveralls B 2 Non Permeable Cov
C 1 Disposable Gloves C 2 Reusable Gloves
D 1 Safety Glasses/Goggles D 2 Face Shield
E 1 Half Face Respirator E 2 Full Face Respirator
F List type of air purifying cartridges used
G Self-Contained Breathing Apparatus (PD or PP)
H Supplied Air (PD or PP)
I Other
J Other

FIGURE A-4 Hazardous Material Access Log

9 0 MEDICAL RESPONSE

This is a statement of procedures to be followed in the event of a medical emergency at the site The plan is divided into several separate procedures depending on the severity of the injury It is the responsibility of the Project Manager to judge the severity of injuries and take appropriate action Basic first aid will be administered by RES personnel as necessary until medical assistance is available All RES personnel are trained in American Red Cross First Aid and CPR A first aid kit will be kept in the office part of the trailer

Emergency Accidents

Immediately call for EG&G Response at 966-2911 and give details of emergency, and exact location

Non-emergency Accidents Requiring Medical Attention

Anyone involved in an accident resulting in injury requiring non-emergency medical assistance (i e , minor cut, sprains, etc) will be sent to

Hospital Name Arvada Emergency Clinic

Address 5730 Ward Road, Arvada, Colorado

Phone (303) 422-8090

Directions From east gate at Rocky Flats, go right on Indiana and proceed south to 64th Ave Turn left, and go to Ward road Turn right on Ward Rd and go south to 57th Ave Turn left into clinic

9 1 RECORD KEEPING

The Health and Safety Liaison Officer or SHSC shall retain a copy of the completed Figure A-3 for each employee in the Confidential Employee Training and Medical Certification File at the ER remedial project work site

The Occupational Safety Division will maintain the completed figure A-4 along with the exposure data gathered during area sampling and personnel monitoring

These records must be accessible to the employee for review

9 2 MEDICAL SURVEILLANCE

Pre-employment and periodic update medical examinations are required for persons working with, or those who may be assigned to work with hazardous waste The medical examination must have been

within a 12-month period prior to on-site activity and repeated annually Physical examinations are conducted for RES workers by Tridem Medical Services in Denver, Colorado A fitness for duty statement for each worker will be kept on site A description of the RES Medical Monitoring Plan is on file in the RES office and on site in trailer

10 0 DECONTAMINATION

Workers having contact with the contaminated water (via sampling raw and contaminated water or system maintenance or accidental exposure) will decontaminate themselves in the deluge shower at the trailer Workers will wash their hands with water following each sampling Following an accidental exposure to the skin, workers will flush their skin with water for fifteen minutes Following an accidental exposure to the eyes, workers will flush their eyes for fifteen minutes with water The RES Project Manager will evaluate the circumstances and extent of any exposure for reporting to EG&G H/S Manager

All PPE shall be collected, segregated and properly disposed of Disposal shall meet all Federal, State, and DOE policies

Tools and equipment shall be properly "deconned" and inspected before removal from site

11 0 COMMUNICATION

The small work area and close proximity of workers will allow face to face communication among workers A phone will be located in the office part of the trailer for communication in emergencies

If necessary, two way radios will be incorporated where employees are outside a line of site from each other

General hazard areas (i e hardhat, eyeprotection, etc) will be properly identified and marked with signs advising of danger or exposure potential

The on-site emergency phone number is 966-2911 This will activate the fire department and security to any situation

All D O E and Rocky Flats emergency procedures shall be followed

Alarm	Device/sound pattern	Action to be taken
Evacuation	Boat Hailer/1 long blasts	Evacuate the controlled area or move to an area of safe refuge until evacuation can be completed
Take Cover	Boat Hailer/2 short blasts	Move to an area of safe refuge until "ALL CLEAR" is sounded

11 1 SITE SAFETY EQUIPMENT

FIRST AID KITS

TYPE	LOCATION
50 Item Standard	Trailer
10 Item Standard	Vehicles

Note All first aid kits shall be approved in accordance with 29 CFR 1910 151

FIRE EXTINGUISHERS

TYPE	LOCATION
10 # A, B, C	Trailer
2 1/2 # A, B C	Vehicles

EYEWASH/DELUGE SHOWER/HANDWASH STATION

TYPE	LOCATION
15 Gallon Portable Eyewash/Shower	Trailer

PERSONAL PROTECTIVE EQUIPMENT

TYPE	AMOUNT
*Hardhat	3 EA
Saranex	1 CS
*PVC Boots	4 PR
Nitrile Gloves	2 DOZ
Duct Tape	4 ROLL
Splash Shield	2 EA
*Ear Plugs	50 PR
*Safety Glasses	6 PR

Note These items (*) are issued to RES personnel, and RES will provide additional supplies to employees as necessary, amounts indicated are in addition to these issued

12 0 MONITORING

EG&G will provide badges for all RES personnel RES employees will authorize results of the badges to be released to EG&G and RES During the construction phase a daily sweep of the area will be conducted by EG&G An air monitoring station will also be near the area (operated by EG&G) to check for airborne contamination

Ultimately RES personnel will begin to do their own monitoring upon completion of EG&G Rad safety and operation classes

RES will make regular observations of the wind direction using such visual indicators as wind flag To avoid inadvertent exposure to harmful dusts, employees will be warned to remain upwind of all work areas whenever possible Work will shut down if wind speeds exceed 15 mph Dust suppression by means of spraying the soil with water may be necessary when visible dust is present

When working in or around confined spaces continuous monitoring with LEL, and O_2 meters shall be used as generally required by RES Class A & B confined space entry In addition a Rad sweep shall also be conducted to assure worker safety Copies of RES confined space procedures are in the Appendix A of this plan

During GAC unit service, RES will leave access doors to the trailer to allow addiquate ventilation

I CERTIFY THAT I HAVE READ AND UNDERSTAND THIS HEALTH AND SAFETY PLAN FOR THE INSTALLATION OF THE OU2 GAC TREATMENT SYSTEM

PRINT NAME	SIGNATURE	COMPANY	DATE

I CERTIFY THAT I HAVE READ AND UNDERSTAND THIS HEALTH AND SAFETY PLAN FOR THE INSTALLATION OF THE OU2 GAC TREATMENT SYSTEM

PRINT NAME	SIGNATURE	COMPANY	DATE

I CERTIFY THAT I HAVE READ AND UNDERSTAND THIS HEALTH AND SAFETY PLAN FOR THE INSTALLATION OF THE OU2 GAC TREATMENT SYSTEM

PRINT NAME	SIGNATURE	COMPANY	DATE

HSP FIELD CHANGE

Field Change Number _____ Date Effective _____

- *Pen and Ink* changes to be made in the HSP to alert the reader o h s change

_____

_____

_____

- Reason for the change to be incorporated into the HSP

_____

_____

_____

_____

- Text of Change to be incorporated

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

HSP FIELD CHANGE

Field Change Number _____ Date Effective _____

Review and Approval Signatures

_____ / _____
ER Health and Safety Officer Date

_____ / _____
ER Program Manager Date

_____ / _____
Director - Environmental Restoration Date

_____ / _____
Health and Safety Liaison Officer Date

_____ / _____
Occupational Safety Manager Date

_____ / _____
Director - Health and Safety Date

RIEDEL ENVIRONMENTAL TECHNOLOGIES INC
CONFINED SPACE ENTRY PROCEDURES
2/8/91
(Rev 5)

This procedure will be followed by all RES personnel entering a confined space for any work task Strict adherence with this procedure is necessary to prevent serious injury or death Failure to follow this procedure will be considered a serious violation of RES safety policy and will result in disciplinary action

This procedure is based on guidelines contained in the NIOSH criteria document Working in Confined Spaces published December 1979 and meets or exceeds current Federal and State safety regulations

All personnel entering a space must be thoroughly trained in this procedure Special emphasis must be placed on ensuring that personnel can perform rescue operations efficiently

I. RET POLICY

A No person under any circumstances will enter a space containing an explosive or oxygen enriched atmosphere or one which has been deliberately inerted (oxygen deficient) for the purpose of making it safe for hot work

B Decisions to enter a space deemed IDLH (referring to a toxic gas or vapor) will be made in conjunction with the Regional Safety Manager/Safety professional As a general rule policy will be to avoid entry in these conditions When required an entry to IDLH or possible IDLH will also wear Level B Note that an IDLH atmosphere does not necessarily offer the same immediate hazard as oxygen deficient or explosive atmospheres

C Any person or persons entering a space of unknown hazard will wear a supplied air respirator and retrieval equipment and will be backed up by a rescue person dressed to a similar level of protection

D All entries into spaces with unknown hazards will be supervised by a RES manager completely familiar with this procedure This manager will be responsible for enforcing all the provisions contained in this procedure

E No matches lighters or any other items capable of producing a spark or flame are allowed in confined spaces No approved explosion proof flashlights or lanterns shall not be used in or within 25 feet of a confined space containing potentially ontaining flammable vapors or gases

F All procedures will be discussed with all involved personnel prior to the entry

G Any deviations from this procedure will require the approval of the Regional Safety Manager

II. DEFINITIONS

A Atmosphere

Generic term for gases vapors mists fumes and dusts within a confined space

B **Atmosphere Testing/Air Monitoring**

The use of a combustible gas/oxygen meter and/or a gas specific instrument to monitor the atmosphere inside a confined space This definition includes the previous RET policy on instruments that

1 All instruments are to be calibrated or span checked prior to use

2 Any monitoring will be performed by personnel familiar with equipment operation

3 Daily span check records will be maintained in the permanent job file

C **Confined Space**

A confined space is one with one or more of the following traits limited openings for entry and exit limited natural ventilation toxic or oxygen deficient atmospheres and/or areas that are not designed for continuous occupancy Examples are storage tanks underground sumps pipelines pits trenches tunnels ship holds etc

D **Confined Space Class A**

A confined space that presents extreme immediate hazard conditions to occupants These would include any one or more of the following oxygen deficiency potentially flammable or explosive atmospheres or toxic IDLH atmospheres Specific parameters include

1	Oxygen	Less than 19 5%
2	Lower Explosive Limit	Greater than 10%
3	Toxic Atmosphere	Greater than IDLH (or possible to exceed)

Personnel will wear Level B protection during entry

E **Confined Space Class B**

A space that has potential for developing adverse health and safety conditions for personnel if preventative measures are not taken Specific measurement parameters

1	Oxygen	19 5% - 24 9%
2	LEL	Less than 10%
3	Toxic	Greater than PEL but less than IDLH and Respirator MAC

Personnel will wear Level c protection during entry

F **Confined Space Class C**

A confined space that has limited hazards such that special modifications are not needed for work procedures Specific measurement parameters

1.	Oxygen	19 5 to 24 9%
2.	LEL	I ess than 10%
3.	Toxic	Less than PEL

Personnel can wear Level D protection during entry

G **Confined Space Entry Permit**

1 A RES form (RET 041) which needs to be filled out prior to any confined space entry Complete use of the form will insure that all health and safety considerations have been addressed prior to entry This form is signed by all personnel and acts as a permit for the entry This form is used in conjunction with this procedure to determine special precautions necessary for entry

2 The second side of the form contains a section for recording air monitoring and equipment calibration data

3 The permit becomes a permanent part of the job file An example form is attached

H **Fall Protection**

Equipment and procedures utilized to prevent falls while entering and exiting a confined space A specific RES procedure titled Fall Protection Procedures March 1989 (Rev 2) is to be followed when fall potentials or difficult retrieval conditions exist

I **Hot Work**

Any work being performed that presents an ignition or heat source Examples are welding grinding burning chop saw abrasive disk usage or chipping

J **Inerting**

1 The process of purging the atmosphere of a space with an inert gas (one which will not support combustion) to eliminate the potential for fire or explosion The typical gas used will be either carbon dioxide or nitrogen Inerting does not remove the source of flammable vapor (i e flammable liquids) but instead removes the oxygen/flammable vapor above the liquid

2 A RES procedure titled Tank Inerting Demolition/Repair Procedure (Rev) is to be used when inerting procedures are needed

3 Personnel are not to enter tanks that have been inerted until the space has been purged with fresh air

K **Intrinsically Safe/Explosion Proof**

1 Electrical equipment which does not present the potential for electrical spark and/or which is designed and constructed to contain any fire or explosion inside the unit preventing propagation of fire back into the general environment This equipment has been certified as safe for use in flammable atmospheres

2 All electrical equipment taken into a space containing (or previously containing) flammable liquids or vapors will be rated Class I Group C & D at a minimum and Class II Group G at a minimum

L **Isolation**

The act of ensuring that the space cannot be accidentally refilled with product which produce and or re energized electrically or mechanically while personnel are inside

M **Lockout**

1 The act of physically locking out electrical hydraulic or pneumatic controls and/or mechanical linkage to ensure isolation Typically performed by lock and key or the physical removal of key components that make it impossible for a system to be restarted while personnel are working on or inside the system

2 A RES procedure titled Electrical and Mechanical Lockout is to be used when lockout is needed

N **Mechanical Ventilation**

1 A method of providing ventilation into a confined space Typically provided by electrically powered or air driven blowers From a ventilation engineering standpoint, air blown into a space is the most effective in ensuring consistent dilution inside the space

2 Negative pressure can be provided by placing the blower inside the space This method can be effective in ensuring that clean air is drawn into the space but is not as effective in producing uniform dilution of contaminants

3. Use of continuous mechanical ventilation will be necessary when working inside Class A or B spaces Ventilation must be provided at the minimum rate of four (4) air changes per hour

4. Flexible tubing or duct work is used to distribute air to all areas of the space Ventilation equipment must be bonded and grounded

5. Considerations must be made for dealing with flammable vapors displaced from a space Exhausted gas may have to be ducted to a safe location

O **Natural (Gravity) Ventilation**

Ventilation provided to a space by non-mechanical means Air moving into a space opening would be considered natural ventilation This is <u>not</u> an effective method for ensuring the safety of personnel and/or reducing the flammability potential inside the confined space

P **Oxygen Deficiency**

An atmosphere where oxygen concentration is less than 19 5% by volume State and Federal safety regulations require that personnel wear air supplied respirators in oxygen deficient atmospheres

Q **Oxygen Enriched**

An atmosphere where oxygen concentration is greater than 25% by volume Fire and explosion potentials are increased greatly

R **Purging**

The displacement of the atmosphere inside a space with fresh air or an inerting gas

S **Emergency Retrieval Equipment**

1 Mechanical hoist equipment designed to raise and lower personnel from a space This equipment is attached to a tripod or other supporting structure which are capable of being a support platform for other fall protection equipment All equipment used for raising or lowering personnel will be rated for such operations by the manufacturer

2 Use of this equipment is described in the RES procedure Fall Protection Procedures

T **Rescue Person**

A person dressed to the same level of protection as the entry person This individual s sole function is rescue A rescue person will be required for all Class A and B space entries

U **Support Person**

A person who will be stationed outside a confined space while workers are inside This person is trained in confined space procedures This person does not have other duties that will take him away from the confined space while workers are inside

V **Saddle Vent**

A piece of equipment that allows a ventilation duct to be placed in a manhole and still allow personnel to enter/exit without the duct being removed This allows continuous ventilation inside the space

W **Unknown Hazard**

A space where the hazard potential is unknown Air monitoring from outside the space is unable to determine if all areas inside are free of hazard In these case personnel will consider the space Class A

Y **Zero Mechanical State (ZMS)**

The point where all power sources that can produce a machine member movement have been neutralized This includes all pneumatic electrical and mechanical components

III POTENTIAL HAZARDS

The following represent the general hazards that can be expected in the variety of confined space jobs RFT personnel have or will be exposed to Each hazard must be assumed until proved otherwise

A Insufficient or Enriched Oxygen

B Toxic dusts mists fumes smoke vapor and gas

C Flammable and explosive gases liquids vapors and dusts

D Inadequate access opening for entry/egress

E Start up of agitators tumblers crushers mixing blades screw conveyors saws etc

F Avalanche of materials or falling objects

G Opening of feed lines which introduce corrosives heated or gaseous substances such as steam water blast furnace gas or other substances hazardous to health

H Electrical shock or electrocution from plug-in lights tools or other portable equipment

I Temperature extremes

J Pressurized lines containing hydraulic oil gas or other fluids

K Inadequate illumination

L Distance of work area from exit and obstacles in between

IV PRE-ENTRY PROCEDURES SUMMARY

A Confined Space Classification

Specific requirements for entry into confined spaces will be based on the pace classification These requirements are summarized on a one page summary form An X next to each sub item means that specific item is a requirement An O next to the item means that it is an option based on the specifics of that entry The RES Regional Safety Manager has the responsibility for determining what optional items will be required on the project

B Confined Space Entry Permit System

An Entry Permit shall be completed prior to entry into any confined pac This permit shall be available at the work site location of the confined spice and shall be dated and valid for one shift only

1. The RES entry permit (RET 041) is required for all entries

2. All questions on the form must be filled out Pay close attention to identifying the correct classification of the space

3. When answering the questions on side 1 of the permit the goal is to have a yes answer to each question In some cases a n/a is appropriate and would indicate that the specific item does not apply to the situation Use caution when deciding that the item is n/a

4. Special attention must be directed to any question where the answer is no A no answer may indicate that adequate precautions have <u>not</u> been taken or that a hazard possibly continues to exist Entry will not be made until all no conditions have been corrected

5. The Entry permit cannot be completed until all testing and sampling has been accomplished This means that it must be filled out at the site under actual working conditions

6 The project Safety Officer as named on the entry permit shall evaluate plan and implement the procedures necessary to safeguard the personnel assigned to the job He/she has responsibility to evaluate/approve any n a or no answers on the permit

C **Work Space History**

Efforts should be made to determine the present and previous products contained in the confined space This information should be listed on the permit form

D **Initial Atmosphere Testing**

1 Prior to entry all spaces will be initially tested for flammable vapors and oxygen deficiency, plus toxic vapor or gases (based on the potential for toxic being present)

2 The person assigned the task of monitoring shall know the proper procedure for calibration and operation of all sampling equipment

3 CGIs will be span checked prior to entry to ensure proper operation and will be calibrated if needed CGIs will <u>not</u> be used for certifying an area safe for entry if a span check has not been made

4 Oxygen meters used to confirm the completeness of inerting will be tested with a 100% inert gas atmosphere to ensure that the meter will read 0% oxygen

5 When monitoring measurements will be made from top to bottom and in all remote sections of the space It may be necessary to enter the space to test remote locations In these situations personnel will be dressed in Level B PPE and will have rescue personnel available who are also dressed to the same level of PPE

E **Isolation/Lockout/Zero Mechanical State**

Before entering any confined space personnel will take sufficient steps to ensure that it is impossible for toxic contaminants or potentially hazardous products to re nter a space or hazardous situations to develop while personnel are inside

1 **Electrical Isolation/Lockout**

a Shall be achieved by locking circuit breakers and/or disconnecting the ON position level with a key type padlock

b Ideally the key is to remain with the person working inside he confined space If more than one person is inside the confined space each person shall place his/her own lock on the electrical disconnect In some cases it may be more feasible for one supervisor to have the lock for an entire trade group with the understanding that this supervisor is responsible for insuring all individuals have safely accounted for before removing the lock

2 **Mechanical/Pneumatic Isolation**

a Isolation of all moving parts shall be achieved by disconnecting or capping any linkage valves drive belts shafts water/steam lines chaining controls or systems which enter feed or impact in the confined space

b Equipment with moving mechanical parts shall be blocked so that there can be no accidental movement

c Pneumatic and hydraulic lines will be bled to remove any remaining pressure to remove possibility of equipment movement

3 **General Guidelines**

a Make certain that you can t accidentally re-energize a system ie that there are not any additional run buttons that you might have missed

b Try all operator switches in all control positions

c Before using voltage tester on unknown system try it on a known energy source

d Check circuits on the load side after they have been disconnected

e After performing voltage check, recheck tester on a known source

f Discharge any electrical or mechanical component that can contain potential energy

4 While performing work on at non RET location it is not always possible to have total control over a client s property When there is question about the adequacy of isolation RET job managers are required to contact the RES/RET Safety Coordinator/Manager to ensure that adequate steps are being taken

F Purging and Ventilation

1 Prior to entry mechanical ventilation will be initiated for Class A and B spaces to reduce or maintain flammable vapor levels to 10% LEL or less

2 Ventilation will be continuous in Class A/B spaces Note that ventilation is not always sufficient to ensure that toxic environments are rendered safe (below PEL or IDLH concentrations)

3 Note that this ventilation will discharge contaminants outside the space and will therefore present exposure potentials to outside personnel This discharge may also present fire or explosion hazards outside the space

4 Electrical fans will not be placed inside a space that contains flammable vapors

5 When entering manholes or other small openings a saddle vent will be utilized if the duct work will interfere with entry/egress An alternative is to use flexible poly tubing which can be easily compressed which will allow passage without removal

category C if eye/skin irritating mists chemicals vapors or dusts are present

b All respirators shall be NIOSH/MSHA approved devices and shall be fitted and maintained in accordance with the RET Respiratory Protection policy

c All persons wearing respirators in a confined space and rescue personnel shall have attended a respiratory training program on the specific respiratory equipment they are wearing

5 Body Protection

All workers entering a confined space shall wear full coverage work clothes sufficient to protect the wearer against known or suspected toxic or irritating materials Specific type of suit material will be described in the permit

6 Hearing Protection

Many times reverberation or ventilation systems result in increased noise levels in confined spaces Hearing protection shall be used when noise levels and exposure times exceed those in 29 CFR 1910 95 or State standards

7 All workers shall wear a hard hat

6 Ventilator air intakes shall be located so they will not pickup exhaust gases from vehicles heaters furnaces or adjacent operations capable of generating airborne contaminants

7 Duct work should be placed so that there are unnecessary bends are eliminated One 90 degree bend can reduce the output to 70% of rated capacity two 90 degree bends to 50% three bends to 33% etc

G Safety Equipment

The following equipment requirements are to be considered minimum and must be provided prior to start up and initial entry of the individual

1 Oxygen and Combustible Gas Indicators calibration kit and response chart appropriate to test for and interpret the flammable atmosphere

2 Photo Ionizing Detector Detector tubes as appropriate to determine toxic content of atmosphere

3 Mechanical ventilation equipment ie blowers compressor hoses and auxiliary equipment as designated for the confined space

4 Respiratory/Face protection

a The exact level and type shall be determined by the regional health and safety officer based upon the conditions and test results of the confined space and the work activity performed Full face protection ie full face respirator (category A/B) or full-face plexiglass shield for category C if eye/skin irritating mists chemicals, vapors or dusts are present

b All respirators shall be NIOSH/MSHA approved devices and shall be fitted and maintained in accordance with the RET Respiratory Protection policy

c All persons wearing respirators in a confined space and rescue personnel shall have attended a respiratory training program on the specific respiratory equipment they are wearing

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7 All workers shall wear a hard hat

8. Rescue Equipment

The specific type and degree of rescue equipment will depend upon the nature of the confined space with regard to access/egress This decision would take into account the exact manner in which the individual could be feasibly extracted ie by the wrists waist straight up and the accompanying strain to the persons body

a A body harness/belt is required when an employee is working in an area that, for purposes of rescue is considered restricted and when any failure of ventilation could allow the build-up of toxic or explosive gases within the time necessary to vacate the area

b A body harness is required for any vertical entry A belt will usually be satisfactory for horizonal entry

c If the worker in the confined space is required to wear a harness the rescue/stand by person shall also have a safety harness and air supplied respirator immediately available

d Additional rescue equipment such as tripod block and tackle lifelines shall be available set-up and in working order if needed to remove a worker from a confined space This equipment must be capable of being hand operated

1 Training

1. Every person who may work in confined spaces or be tasked with providing support for confined space jobs shall have training in the hazards and correct procedures before initial entry into confined space

2. Training shall consist of the following topics

a Respirator training
b Confined space hazard recognition
c Use of ventilation equipment
d atmospheric sampling and testing devices
e use of all rescue and support equipment
f Emergency rescue procedures-practice
g lock out tag out procedures
h required personal protective equipment
i communication system
j CPR/First Aid
k explanation of the RET Confined Space Procedure
l explanation of contingency plan

V ENTRY PROCEDURES OVERVIEW

Entry into a confined space shall be made only when a minimum of 1 person is available outside to handle communication support equipment and to provide assistance or emergency aid as necessary

A Support person

1 All space entries require a standby person assigned to the project This person s duties include maintaining communication and providing necessary assistance to workers inside

2 This individual s primary responsibilities with Class A and B spaces are the initiation of rescue procedures (although this person will never go inside the space)

3 Support persons cannot leave a Class A or B space for any reason

4 Class A and B spaces require that at least two other personnel are in the immediate are in the immediate area and can be summoned without the standby person having to leave the area

5 Class C spaces only require that the person keep a general watch on those inside Communication is either direct verbal or indirect/direct visual

B Rescue Person

1 Class A Spaces

Require that the rescue person be dressed to the same level of protection as the workers he is assigned to He must be on station at the opening to the space in direct line of sight with those inside This person will be on station the entire time that operations are being conducted

2. Class B Spaces

Rescue person not needed

3. Class C Spaces

Rescue person not needed

C Continuous Atmosphere Monitoring

1 It is recognized that the condition in some spaces may change over time Initial testing may under estimate hazards in these situations

2 Continuous monitoring of flammable oxygen and/or toxics will be necessary where conditions could possibly change over a short period of time Examples are welding or cutting inside a tank some cleaning operations accidental release of product into the space, etc

3 Once ventilation is started periodic checks should be made of the surrounding area to insure that contaminated air is exhausted in a location that creates no hazard to people or equipment

4. Remove personnel from the area if monitoring demonstrates that ventilation is not sufficient to maintain the atmosphere below 10% I FL

D Continuous Ventilation

1. Shall be maintained in Class A/B spaces Not needed in Class C if there is no possibility of contaminant generation while personnel are inside

2. Local exhaust ventilation shall be provided when mechanical ventilation is not capable of preventing a point source contaminant from producing unacceptable high concentrations in the ambient atmosphere Example spreading a flammable solvent on a surface inside a tank

E Lighting

1. All portable lights shall be intrinsically safe/explosion proof when working in potentially flammable atmospheres

2. Heavy duty flexible cords will be used with good insulation and connectors No splices are permitted Cracked or worn insulation shall be replaced

3. Lighting shall not be suspended by cords unless specifically designed for it

4. All lights and plug assemblies should be checked with a volt/ground meter *prior to use in confined space*

RIEDEL ENVIRONMENTAL SERVICES, INC
CHECK LIST OF CONSIDERATIONS FOR ENTRY, WORKING IN AND EXITING CONFINED SPACES

ITEM		CLASS A	CLASS B	CLASS C
1	RES Confined Area Entry Permit	x	x	x
2	Initial Atmospheric Testing for Combustibles & Oxygen	x	x	x
3	Continuous Air Monitoring	x	x	0
4	Pre entry Briefing of Personnel	x	x	x
5	Pre-entry Space Preparation			
	Isolate/lockout/Electrical & mechanical	x	x	x
	Purge and continuous ventilation	x	x	0
	Requirements for special equipment/tools	x	x	0
6	Entry procedures			
	Initial written plan with job objectives	x	x	x
	Support person on station	x	x	x
	Rescue person station (dressed to respond)	x	O	0
	Safety Equipment and clothing			
	Head protection	x	x	x
	Hearing protection (>85dBA)	x	x	x
	Hand protection (depending on contaminant)	x	x	x
	Foot protection (depending on contaminant)	x	x	x
	Body protection (depending on contaminant)	x	x	x
	Respiratory protection	x	x	0
	Safety belts with life lines	x	x	0
	Life lines harness retrieval pulley (vertical entry)	x	x	x
8	Rescue procedures developed	x	x	x
9	Record keeping (equipment calibration permits)	x	x	x

x = indicates requirement

O = indicated determination by RES Safety Professional

TIEDEL
ENVIRONMENTAL SERVICES INC

CONFINED SPACE ENTRY PERMIT

ENTRY CHECKLIST

Page of Pages

E _____ JOB NUMBER _____

ENTERED: _____

SIFICATION OF CONFINED SPACE:

( ) CLASS C: >19 5% O_2 <10% LEL <TLV

( ) CLASS B: >19 5% O_2 <10% LEL >TLV <IDLH <MAC

( ) CLASS A <19 5% O_2, >10% LEL, >IDLH >MAC

CHEMICAL CONTAMINANTS: _____ _____ _____

DESCRIPTION OF WORK _____

NUMBER OF PEOPLE REQUIRED ON PROJECT _____

TIME ISSUED _____ VALID UNTIL _____

PERMIT IS VOID AT THE END OF THE WORK SHIFT ON WHICH IS IT ISSUED	YES	NO	N/A
Were hazards testing and emergency procedures explained to all members of crew?			
All chemical and gas delivery lines are disconnected and/or capped?			
St elect ical mechanical pneumatic power sources have been reduced to zero energy state (ZES)?			
Controls to all power sources are locked and tagged out?			
Monitoring equipment has been calibrated/span checked?			
Combustible gas vapors are less than 10% LEL?			
Oxygen concentration is greater than 19 5%			
Toxic gas/vapor concentrations are less than IDLH?			

DIRECT READING INSTRUMENT CALIBRATION

	INSTRUMENT USED	LEL SPAN CONC	LEL ACTUAL	H2S SPAN CONC	H2S ACTUAL	CO SPAN CONC	CO ACTUAL	OXY SPAN CONC	OXY ACTUAL

AIR MONITORING DATA

TIME	INSTRUMENT USED	CONTAMINANT (LEL O2 ETC)	MEASURED LEVEL

TIME	INSTRUMENT USED	CONTAMINANT (LEL O2 ETC)	MEASURED LEVEL

PROJECT EQUIPMENT REQUIREMENTS

Personnel Protective Equipment

_____ Outer Suit Type _____

_____ Chemical Boots

_____ Outer Gloves Type _____

_____ Hard Hat

Respirators

_____ SCBA

_____ Supplied Air with 5-minute Egress

_____ Grade D Air Cylinders

_____ Compressor with Purifier

DIRECT READING INSTRUMENT CALIBRATION

	INSTRUMENT USED	LEL SPAN CONC	LEL ACTUAL	H2S SPAN CONC	H2S ACTUAL	CO SPAN CONC	CO ACTUAL	OXY SPAN CONC	OXY ACTUAL

AIR MONITORING DATA

TIME	INSTRUMENT USED	CONTAMINANT (LEL O2 ETC)	MEASURED LEVEL

TIME	INSTRUMENT USED	CONTAMINANT (LEL O2 ETC)	MEASURED LEVEL

PROJECT EQUIPMENT REQUIREMENTS

Personnel Protective Equipment

____ Outer Suit Type _____

____ Chemical Boots

____ Outer Gloves Type _____

____ Hard Hat

Respirators

____ SCBA

____ Supplied Air with 5-minute Egress

____ Grade D Air Cylinders

____ Compressor with Purification Panel

99/CO:703

UNION CARBIDE

UNION CARBIDE CORPORATION

CARBON PRODUCTS DIVISION

MATERIAL SAFETY DATA SHEET

(Essentially similar to Form OSHA-20)

SECTION I	
Manufacturer s Name UNION CARBIDE CORPORATION, Carbon Products Div	Emergency Telephone No (304) 744-3487 (Day or Night)
Address (Number Street City State and ZIP Code) 270 Park Avenue New York New York 10017	
Product ACTIVATED CARBON	Trade Name and Synonyms "Columbia" - All Grades

SECTION II - HAZARDOUS INGREDIENTS					
MATERIAL	%	TLV *	MATERIAL	%	TLV *
None as defined by United					
States Department of Labor					
29 CFR 1915 1916 1917					

* Current American Conference of Governmental Industrial Hygienist Limits

SECTION III PHYSICAL DATA			
BOILING POINT (F)	N/A	SPECIFIC GRAVITY (H_2O 1)	0 9
VAPOR PRESSURE (mm Hg)	N/A	PERCENT VOLATILE BY VOLUME (%)	N/A
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE (_____ =1)	N/A
SOLUBILITY IN WATER	None		
APPEARANCE AND ODOR	Black odorless granules		

SECTION IV FIRE AND EXPLOSION HAZARD DATA				
FLASH POINT (Method used)	N/A	FLAMMABLE LIMITS % by Volume	Lel = N/A	Uel = N/A
EXTINGUISHING MEDIA	Water foam CO_2 dry chemicals			
SPECIAL FIRE FIGHTING PROCEDURES	N/A			
UNUSUAL FIRE AND EXPLOSION HAZARDS Fire and explosive hazard of adsorbed materials must be identified and adequate protective measures taken				

Continued on reverse side

SECTION V HEALTH HAZARD DATA

THRESHOLD LIM T VALUE: 10 mg/m^3 (ACGIH limit for nuisance dusts)

EFFECTS OF OVEREXPOSURE
Inhalation of activated carbon dust may cause temporary respiratory irritation and discomfort Potential hazard of adsorbed materials on used activated carbon should be identified.

EMERGENCY AND FIRST AID PROCEDURES

N/A

SECTION VI REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID N/A
	STABLE	X	

INCOMPATABILITY *(Materials to avoid)* N/A

HAZARDOUS DECOMPOSITION PRODUCTS
N/A

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID N/A
	WILL NOT OCCUR	X	

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Follow good housekeeping practices

WASTE DISPOSAL METHOD
Dispose of in approved landfill, recognizing the potentially hazardous nature of adsorbed materials

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*
For above TLV dust concentration wear NIOSH-approved respirator

VENTILATION	LOCAL EXHAUST N/A	Special N/A
	MECHANICAL *(General)* Maintain dust level below TLV	Other None

PROTECTIVE GLOVES: Recommended
EYE PROTECTION: Safety glasses or goggles

OTHER PROTECTIVE EQUIPMENT: N/A

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Do not enter vessel containing activated carbon without adequate breathing air supply

Closed vessels may be low in oxygen level due to adsorbing characteristics of activated carbon

OTHER PRECAUTIONS
New activated carbon - store in closed containers indefinitely Outside storage keep on pallets and under tarpaulins to keep container dry Do not breathe dust

OILS, FUEL: 1-D

OOD

Common Synonyms			
Diesel oil (light)	Oily liquid Floats on water	Yellow brown	Lube or fuel oil series

Stop discharge if possible
Call fire department
Avoid contact with liquid
Isolate and remove discharged material
Notify local health and pollution control agencies

Fire

Combustible
Extinguish with dry chemical foam or carbon dioxide
Water may be ineffective on fire
Cool exposed containers with water

Exposure

CALL FOR MEDICAL AID

LIQUID
Irritating to skin and eyes
Harmful if swallowed
Remove contaminated clothing and shoes
Flush affected areas with plenty of water
IF IN EYES hold eyelids open and flush with plenty of water
IF SWALLOWED and victim is CONSCIOUS have victim drink water or milk
DO NOT INDUCE VOMITING

Water Pollution

Dangerous to aquatic life in high concentrations
Floating to shoreline
May be dangerous if it enters water intakes
Notify local health and wildlife officials
Notify operators of nearby water intakes

MATERIAL SAFETY DATA SHEET

Distributor
General Air Service & Supply
1115 Zuni Street
Denver Colorado 80204
(303) 892-7003

Manufacturer
Liquid Air Corporation
One Embarcadero Center
San Francisco CA 94111
(415) 765-4500

Product Supplied Reconstituted Breathing Air
Sold To RIFDEL ENVIRONMENTAL SERVICES
5850 EAST 58TH AVE SUITE F
COMMERCE CITY CO 80022

SECTION I

PRODUCT NAME Reconstituted Breathing Air — ISSUE DATE 2/9/85
SYNONYMS Grade E Breathing Air
FORMULA O2-N2 — DOT HAZARD CLASS Non flammable Gas
CHEMICAL FAMILY Gas — DOT ID NUMBER UN1072

SECTION II - HAZARDOUS INGREDIENTS

None

SECTION III - PHYSICAL DATA

BOILING POINT -300 F
LIQUID DENSITY AT BOILING POINT N/A
VAPOR PRESSURE N/A
VAPOR DENSITY (AIR=1) 0.28
SOLUBILITY IN WATER Slight
SPECIFIC GRAVITY 1.00
APPEARANCE AND ODOR Colorless and Odorless Gas

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used) None - Nonflammable
FLAMMABLE LIMITS LEL 0 UEL 0
EXTINGUISHING MEDIA None
SPECIAL FIRE FIGHTING PROCEDURES Remove from direct heat or open flame or keep cool with water fog

SECTION V - HEALTH HAZARD DATA

None

SECTION VI - REACTIVITY DATA

STABILITY Stable
CONDITIONS TO AVOID None
HAZARDOUS POLYMERIZATION Will not occur

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Leaks will dissipate rapidly and harmlessly to atmosphere
WASTE DISPOSAL METHOD Vent to atmosphere in open area Remove valve

SECTION VIII - SPECIAL PROTECTION INFORMATION

None

STORAGE RECOMMENDATIONS Do not drop cylinder Keep valve protection on cylinder except when using Store away from direct heat or open flame Refer to CGA-P1 Safe Handling of Compressed Gases in DOT Cylinders H

SECTION IX - SPECIAL PRECAUTIONS

Material Safety Data Sheet D43224

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY (As Used on Label and List)	Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.
ALCONOX	

Section I

Manufacturer's Name ALCONOX, INC	Emergency Telephone Number (212) 473-1300
Address (Number, Street, City, State, and ZIP Code) 215 PARK AVENUE SOUTH	Telephone Number for Information (212) 473-1300
NEW YORK, N.Y. 10003	Date Prepared JULY 1, 1987
	Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
THERE ARE NO INGREDIENTS IN ALCONOX WHICH APPEARED ON THE OSHA STANDARD 29 CFR 1910 SUBPART Z.				

Section III — Physical/Chemical Characteristics

Boiling Point	N.A.	Specific Gravity (H_2O = 1)	N.A.
Vapor Pressure (mm Hg.)	N.A.	Melting Point	N.A.
Vapor Density (AIR = 1)	N.A.	Evaporation Rate (Butyl Acetate = 1)	N.A.

Solubility in Water
APPRECIABLE (GREATER THAN 10 PER CENT)

Appearance and Odor
WHITE POWDER INTERSPERSED WITH CREAM COLORED FLAKES - ODORLESS

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
NONE		N.A.	N.A.

Extinguishing Media
WATER, CO_2, DRY CHEMICAL, FOAM, SAND/EARTH

Special Fire Fighting Procedures
FOR FIRES INVOLVING THIS MATERIAL DO NOT ENTER WITHOUT PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS.

Unusual Fire and Explosion Hazards
NONE

Stability			
	Unstable		Conditions to Avoid: NONE
	Stable	XX	

Incompatibility (*Materials to Avoid*): AVOID STRONG ACIDS

Hazardous Decomposition or Byproducts: MAY RELEASE CO_2 GAS ON BURNING

Hazardous Polymerization			
	May Occur		Conditions to Avoid: NONE
	Will Not Occur	XX	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? YES; Skin? NO; Ingestion? YES

Health Hazards (*Acute and Chronic*): INHALATION OF POWDER MAY PROVE LOCALLY IRRITATING TO MUCOUS MEMBRANES. INGESTION MAY CAUSE DISCOMFORT AND/OR DIARRHEA

Carcinogenicity: NTP? NO; IARC Monographs? NO; OSHA Regulated? NO

Signs and Symptoms of Exposure: EXPOSURE MAY IRRITATE MUCOUS MEMBRANES. MAY CAUSE SNEEZING

Medical Conditions Generally Aggravated by Exposure: RESPIRATORY CONDITIONS MAY BE AGGRAVATED BY POWDER.

Emergency and First Aid Procedures: EYES-FLUSH WITH PLENTY OF WATER FOR 15 MINUTES SKIN-FLUSH WITH PLENTY OF WATER INGESTION-DRINK LARGE QUANTITIES OF WATER, GET MEDICAL ATTENTION FOR DISCOMFORT

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled: MATERIAL FOAMS PROFUSELY. SHOVEL AND RECOVER AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.

Waste Disposal Method: SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR NON-HAZARDOUS DETERGENT

Precautions to Be Taken in Handling and Storing: STORE IN A DRY AREA TO PREVENT CAKING

Other Precautions: NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL.

Section VIII — Control Measures

Respiratory Protection (*Specify Type*): DUST MASK

Ventilation		
	Local Exhaust: NORMAL	Special: N.A.
	Mechanical (General): N.A.	Other: N A

Protective Gloves: USEFUL-NOT REQUIRED

Eye Protection: USEFUL-NOT REQUIRED

Other Protective Clothing or Equipment: NOT REQUIRED

Work/Hygienic Practices: NO SPECIAL PRACTICES REQUIRED

USG 0 [illegible] 529/65775

Topic ACETONE

OVERVIEW
Material name
ACETONE
Common synonyms
Dimethyl ketone
Propanone
2-Propanone
Characteristics
Watery liquid Colorless Sweet odor
Floats and mixes with water Flammable irritating vapor is
produced
Emergency actions
Stay upwind and use water spray to knock down vapor
Shut off ignition sources and call fire department keep
people away
Stop discharge if possible
Isolate and remove discharged material
Avoid contact with liquid and vapor
Notify local health and pollution control agencies
Fire
FLAMMABLE
Flashback along vapor trail may occur
Vapor may explode if ignited in an enclosed area
Extinguish with dry chemical alcohol foam or carbon
dioxide
Water may be ineffective on fire
Cool exposed containers with water
Exposure
CALL FOR MEDICAL AID
VAPOR
Irritating to eyes nose and throat
If inhaled may cause difficult breathing or loss of
consciousness
Move to fresh air
If breathing has stopped give artificial respiration
If breathing is difficult give oxygen
LIQUID
Irritating to eyes
Not irritating to skin
IF IN EYES hold eyelids open and flush with plenty of
water
Water pollution
Dangerous to aquatic life in high concentrations
May be dangerous if it enters water intakes
Notify local health and pollution control officials
Notify operators of nearby water intakes
RESPONSE TO DISCHARGE
Issue warning high flammability Disperse and flush
LABEL
Category Flammable liquid
Class 3
CHEMICAL DESIGNATIONS
Compatibility class Ketone
Formula CH_3COCH_3
IMO/UN designation 3.1/1090

Topic ACETONE

DOT id no 1090
CAS registry no 67-64-1

OBSERVABLE CHARACTERISTICS

Physical state Liquid
Color Colorless
Odor Sweetish pleasant resembling that of mint or fruit pungent sharp penetrating residual ketonic pleasant non-residual

HEALTH HAZARDS

Personal protective equipment Organic vapor canister or air-supplied mask synthetic rubber gloves chemical safety goggles or face splash shield
Symptoms following exposure INHALATION vapor irritating to eyes and mucous membranes acts as an anesthetic in very high concentrations INGESTION low order of toxicity but very irritating to mucous membranes SKIN prolonged excessive contact causes defatting of the skin possibly leading to dermatitis
Treatment of exposure INHALATION if victim is overcome remove to fresh air and call a physician administer artificial respiration if breathing is irregular or stopped INGESTION if victim has swallowed large amounts and is conscious and not having convulsions induce vomiting and get medical help promptly no specific antidote known SKIN wash well with water EYES flush with water immediately for at least 15 min Consult a physician
Threshold limit value 750 ppm
Short term inhalation limits 1000 ppm for 30 min
Toxicity by ingestion Grade 1 LD(50) = 5 to 15 g/kg (dog)
Late toxicity Not pertinent
Vapor (gas) irritant characteristics If present in high concentrations vapors cause moderate irritation of the eyes or respiratory system Effect is temporary
Liquid or solid irritant characteristics No appreciable hazard Practically harmless to the skin because it is very volatile and evaporates quickly from the skin
Odor threshold 100 ppm
IDLH value 20000 ppm

FIRE HAZARDS

Flash point 4 degrees F O C 0 degrees F C C
Flammable limits in air 2 6/-12 8/
Fire extinguishing agents Alcohol foam dry chemical carbon dioxide
Fire extinguishing agents NOT to be used Water in straight hose stream will scatter and spread fire and should not be used
Special hazards of combustion products Not pertinent
Behavior in fire Not pertinent
Ignition temperature 869 degrees F
Electrical hazard Class I Group D
Burning rate [illegible] mm min
Adiabatic flame temperature Data not available
Stoichiometric air to fuel ratio Data not available
Flame temperature Data not available

Topic ACETONE

CHEMICAL REACTIVITY
Reactivity with water No reaction
Reactivity with common materials No reaction
Stability during transport Stable
Neutralizing agents for acids and caustics Not pertinent
Polymerization Not pertinent
Inhibitor of polymerization Not pertinent
Molar ratio (reactant to product) Data not available
Reactivity group 18

WATER POLLUTION
Aquatic toxicity 14 250 ppm/24 hr/sunfish/killed/tap water
13 000 ppm/48 hr/mosquito fish/TLm/ turbid water
Waterfowl toxicity Not pertinent
Biological oxygen demand (BOD) (Theor) 122 5 days
Food chain concentration potential Not pointed

SHIPPING INFORMATION
Grades of purity Technical 99 5/ plus 0 5/ water Reagent
99 5/ plus 0 5/ water
Storage temperature Ambient
Inert atmosphere No requirement
Venting Open (flame arrester) or pressure-vacuum

HAZARD CLASSIFICATIONS
Code of federal regulations Flammable liquid

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	0
Poisons	0
Water Pollution	
Human Toxicity	-
Aquatic Toxicity	
Aesthetic Effects	1
Reactivity	
Other Chemicals	2
Water	
Self Reaction	1

NFPA HAZARD CLASSIFICATION

Category	Classification
Health Hazard (Blue)	
Flammability (Red)	3
Reactivity (Yellow)	0

PHYSICAL AND CHEMICAL PROPERTIES
Physical state at 15 degrees C and 1 ATM Liquid
Molecular weight 58 08
Boiling point at 1 ATM 133 degrees F 56 1 degrees C
[illegible] degrees C
Freezing point 178 degrees F - -94 degrees C 178 5 degrees K
Critical temperature 455 degrees F 235 degrees C - 508 degrees K
Critical pressure 682 psia - 46 4 atm 4 70 MN m(2)
Specific gravity 0 791 at 20 degrees C (liquid
Liquid surface tension Not pertinent

Topic ACETONE

Liquid water interfacial tension Not pertinent
Vapor (gas) specific gravity 2 0
Ratio of specific heats of vapor (gas) 1 127
Latent heat of vaporization 220 Btu/lb = 122 cal/g = 5 11 X 10(5) J/kg
Heat of combustion -12 250 Btu/lb = -6808 cal/g = -285 0 X 10(5) J/kg
Heat of decomposition Not pertinent
Heat of solution Not pertinent
Heat of polymerization Not pertinent
Heat of fusion 23 42 cal/g
Limiting value Data not available
REID vapor pressure 7 25 psia

Topic VINYL CHLORIDE

OVERVIEW
 Material name
   VINYL CHLORIDE
 Common synonyms
   Chlorethylene
   VCL
   Vinyl C Monomer
   VCM
 Char cteristics
   Ga colorless Sweet odor
   Liquid floats and boils on water Flammable irritating
   visible vapor cloud is produced
 Emergency actions
   Stop discharge if possible keep people away
   Sh of ignition sources a d ... fi e depa t n t
   Stav upwind and use water sp ay to knock down vapor
   E acuate area in case of la ge discharge
   Av id contact with liquid and a or
   Noti y local health and pollution control agencies
 Fir
   FLAMMABLE
   POI ONOUS GAS IS PRODUCED IN FIRE
   F a rback along vapor trail ma occur
   Ma explode if ignited in an en losed area
   We self-contained breathi g ap aratus
   Coo e posed containers and p otect men effecting shutoff
   w water
   Stop flow of gas if possible
   Le re burn
   E inguish small fires with d c mical
 E posure
   CALL FOR MEDICAL AID
   VAP
   Ir itating to e es nose and t oat
   If i ale w cause dizzi e s di fi i g
   M e to fresh air
   If breathing has stopped gi e ar ifi ial espiration
   If b eathing is difficult gi e o ge
   L QU
   Will cause frostbite
   Flu r affected areas with pl nt of wate
   DO OT RUB AFFECTED AREAS
 Wat ollution
   o a ful to aquatic life
RESPONSE TO DISCHARGE
  Issue warning-high flammability E acuate area
LABEL
  ateg Flammable gas
  lass
 CHEMI L DESIGNATIONS
 CG ompatibility class Vinyl halid
 Formula CH(2) CHCl
 IMO UN designation 2 0/1086
 DOT 1086
  S t 75-01-4

Topic VINYL CHLORIDE

OBSERVABLE CHARACTERISTICS
Physical state Liquefied compressed gas
Color Colorless
Odor Pleasant sweet

HEALTH HAZARDS
Personal protective equipment Rubber gloves and shoes, gas-tight goggles organic vapor canister or self-contained breathing apparatus
Symptoms following exposure INHALATION high concentrations cause dizziness, anesthesia lung irritation SKIN may cause frostbite phenol inhibitor may be absorbed through skin if large amounts of liquid evaporate
Treatment of exposure INHALATION remove patient to fresh air and keep him quiet and warm call a doctor give artificial respiration if breathing stops EYES AND SKIN flush with plenty of water for at least 15 min for eyes get medical attention remove contaminated clothing
Threshold limit value 5 ppm
Short term inhalation limits 500 ppm for 5 min
Toxicity by ingestion Not pertinent
Late toxicity Chronic exposure may cause liver damage
Vapor (gas) irritant characteristics Vapors cause moderate irritation such that personnel will find high concentrations unpleasant The effect is temporary
Liquid or solid irritant characteristics Minimum hazard If spilled on clothing and allowed to remain may cause smarting and reddening of skin May cause frostbite
Odor threshold 260 ppm
IDLH value Data not available

FIRE HAZARDS
Flash point -110 degrees F O C
Flammable limits in air 4/-26/
Fire extinguishing agents For small fires use dry chemical or carbon dioxide For large fires stop flow of gas Cool exposed containers with water
Fire extinguishing agents NOT to be used Not pertinent
Special hazards of combustion products Forms highly toxic combustion products such as hydrogen chloride phosgenic and carbon monoxide
Behavior in fire Container may explode in fire Gas is heavier than air and may travel considerable distance to a source of ignition and flash back
Ignition temperature 882 degrees F
Electrical hazard Class I Group D
Burning rate 4 3 mm/min
Adiabatic flame temperature Data not available
Stoichiometric air to fuel ratio 5 490 (Est)
Flame temperature Data not available

CHEMICAL REACTIVITY
Reactivity with water No reaction
Reactivity with common materials No reaction
Stability during transport Stable
Neutralizing agents for acids and caustics Not pertinent
Polymerization Polymerizes in presence of air sunlight

Topic VINYL CHLORIDE

or heat unless stabilized by inhibitors
Inhibitor of polymerization Not normally used except when high temperatures are expected Then 40-100 ppm of phenol used
Molar ratio (reactant to product) Data not available
Reactivity group 35

WATER POLLUTION
Aquatic toxicity None
Waterfowl toxicity None
Biological oxygen demand (BOD) None
Food chain concentration potential None

SHIPPING INFORMATION
Grades of purity Commercial or technical 99+/
Storage temperature Under pressure ambient At atm pressure low
Inert atmosphere No requirement
Venting Under pressure safety relief At atm pressure pressure-vacuum

HAZARD CLASSIFICATIONS
Code of federal regulations Flammable gas

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION

Category	Rating
Fire	4
Health	
Vapor Irritant	2
Liquid or Solid Irritant	1
Poisons	-
Water Pollution	
Human Toxicity	0
Aquatic Toxicity	0
Aesthetic Effect	0
Reactivity	
Other Chemicals	-
Water	0
Self Reaction	2

NFPA HAZARD CLASSIFICATION

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	4
Reactivity (Yellow)	1

PHYSICAL AND CHEMICAL PROPERTIES
Physical state at 15 degrees C and 1 ATM Gas
Molecular weight 62 50
Boiling point at 1 ATM 7 [illegible] degrees [illegible] degrees C - 259 4 degrees K
Freezing point -244 8 degrees F -153 8 degrees C - 119 4 degrees K
Critical temperature 317 1 degrees F 158 4 degrees C 431 6 degrees K
Critical pressure 775 psia - 52 7 atm 5 34 MN/m(2)
Specific gravity 0 969 at -13 degrees C (liquid)
Liquid surface tension 16 0 dynes/cm 0 0160 N/m at 25 degrees C
Liquid water interfacial tension (est) 30 dynes/cm 0 03 N/m at 20 degrees C

Topic VINYL CHLORIDE

Vapor (gas) specific gravity 2 2
Ratio of specific heats of vapor (gas) 1 186
Latent heat of vaporization 160 Btu/lb = 88 cal/g = 3 7 X 10(5) J/kg
Heat of combustion -8136 Btu/lb = -4520 cal/g = -189 1 X 10(5) J/kg
Heat of decomposition Not pertinent
Heat of solution Not pertinent
Heat of polymerization -729 Btu/lb = -405 cal/g = 16 9 X 10(5) J/kg
Heat of fusion 18 14 cal/g
Limiting value Data not available
REID vapor pressure 75 psia

Topic DICHLOROMETHANE

OVERVIEW
Material name
DICHLOROMETHANE
Common synonyms
Methylene chloride
Methylene dichloride
Characteristics
Watery liquid Colorless Sweet pleasant odor
Sinks in water Irritating vapor is produced
Emergency actions
Stop discharge if possible
Avoid contact with liquid and vapor
Isolate and remove discharged material
Notify local health and pollution control agencies
Fire
Not flammable
POISONOUS GASES ARE PRODUCED WHEN HEATED
Wear goggles and self-contained breathing apparatus
Cool exposed containers with water
Exposure
CALL FOR MEDICAL AID
VAPOR
Irritating to eyes nose and throat
If inhaled will cause nausea and dizziness
Move to fresh air
If breathing has stopped give artificial respiration
If breathing is difficult give oxygen
LIQUID
Irritating to skin and eyes
Harmful if swallowed
Remove contaminated clothing and shoes
Flood affected areas with plenty of water
IF IN EYES hold eyelids open and flush with plenty of water
IF SWALLOWED and victim is conscious have victim drink water
milk
Water pollution
Effect of low concentrations on aquatic life is unknown
May be dangerous if it enters water intakes
Notify local health and pollution control officials
Notify operators of nearby water intakes
RESPONSE TO DISCHARGE
Dilute and flush
LABEL
Category None
Class Not pertinent
CHEMICAL DESIGNATIONS
CG compatibility class Halogenated hydrocarbon
Formula CH(2)Cl(2)
IMO UN designation 6.1/1593
DOT id no 1593
CAS registry no 75-09-2
OBSERVABLE CHARACTERISTICS
Physical state Liquid

Topic DICHLOROMETHANE

Color Colorless
Odor Pleasant aromatic like chloroform sweet ethereal

HEALTH HAZARDS

Personal protective equipment Organic vapor canister mask safety glasses protective clothing
Symptoms following exposure INHALATION anesthetic effects nausea and drunkenness CONTACT WITH SKIN AND EYES skin irritation irritation of eyes and nose
Treatment of exposure INHALATION remove from exposure Give oxygen if needed INGESTION no specific antidote CONTACT WITH SKIN AND EYES remove contaminated clothing wash skin or eyes if affected
Threshold limit value 100 ppm
Short term inhalation limits 500 ppm for 30 min
Toxicity by ingestion Grade 2 LD(50) = 0 5 to 5 g/kg
Late toxicity None
Vapor (gas) irritant characteristics Vapors cause moderate irritation such that personnel will find high concentrations unpleasant The effect is temporary
Liquid or solid irritant characteristics Minimum hazard If spilled on clothing and allowed to remain may cause smarting and reddening of the skin
Odor threshold 205-307 ppm
IDLH value 5 000 ppm

FIRE HAZARDS

Flash point Not flammable under conditions likely to be encountered
Flammable limits in air 12/-19/
Fire extinguishing agents Not pertinent
Fire extinguishing agents NOT to be used Not pertinent
Special hazards of combustion products Dissociation products generated in a fire may be irritating or toxic
Behavior in fire Not pertinent
Ignition temperature 1184 degrees F
Electrical hazard Not pertinent
Burning rate Not pertinent
Adiabatic flame temperature Data not available
Stoichiometric air to fuel ratio Data not available
Flame temperature Data not available

CHEMICAL REACTIVITY

Reactivity with water No reaction
Reactivity with common materials No reaction
Stability during transport Stable
Neutralizing agents for acids and caustics Not pertinent
Polymerization Not pertinent
Inhibitor of polymerization Not pertinent
Molar ratio (reactant to product) Data not available
Reactivity group 36

WATER POLLUTION

Aquatic toxicity Not pertinent
Waterfowl toxicity Not pertinent
Biological oxygen demand (BOD) Not pertinent
Food chain concentration potential None

SHIPPING INFORMATION

Grades of purity Aerosol grade technical grade

Topic DICHLOROMETHANE

Storage temperature Data not available
Inert atmosphere Inerted
Venting Data not available

HAZARD CLASSIFICATIONS

Code of federal regulations ORM-A

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION

Category	Rating
Fire	1
Health	
Vapor Irritant	2
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	-
Aesthetic Effect	[illegible]
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

NFPA HAZARD CLASSIFICATION

Category	Classification
Health Hazard (Blue)	[illegible]
Flammability (Red)	0
Reactivity (Yellow)	1

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C and 1 ATM Liquid
Molecular weight 84 93
Boiling point at 1 ATM 104 degrees F 39 8 degrees C = 313 0 degrees K
Freezing point -142 degrees F -96 7 degrees C = 176 5 degrees K
Critical temperature 473 degrees F 245 degrees C = 518 degrees K
Critical pressure 895 psia 60 9 atm 6 17 MN/m(2)
Specific gravity 1 322 at 20 degrees C (liquid)
Liquid surface tension Not pertinent
Liquid water interfacial tension Not pertinent
Vapor (gas) specific gravity 2 9
Ratio of specific heats of vapor (gas) 1 199
Latent heat of vaporization 142 Btu lb 78 7 cal/g 3 30 (1 05) J/kg
Heat of combustion Not pertinent
Heat of decomposition Not pertinent
Heat of solution Not pertinent
Heat of polymerization Not pertinent
Heat of fusion 16 89 cal/g
Limiting value Data not available
REID vapor pressure 13 9 psia

Topic CARBON DISULFIDE

OVERVIEW
Material name
CARBON DISULFIDE
Common synonyms
Carbon bisulfide
Characteristics
Watery liquid Colorless to yellow Rotten egg to sweet odor
Sinks in water Flammable irritating vapor is produced
Emergency actions
Avoid contact with liquid and vapor Keep people away
Wear goggles self-contained breathing apparatus and rubber overclothing
(including gloves)
Shut off ignition sources and call fire department
Stop discharge if possible
Stay upwind and use water spray to knock down vapor
Isolate and remove discharged material
Notify local health and pollution control agencies
Fire
FLAMMABLE
Flashback along vapor trail may occur
Vapor may explode if ignited in an enclosed area
Wear goggles self-contained breathing apparatus and rubber overclothing
(including gloves)
Extinguish with dry chemical or carbon dioxide
Water and foam may be ineffective on fire
Cool exposed containers with water
Exposure
CALL FOR MEDICAL AID
VAPOR
Irritating to eyes nose and throat
If inhaled will cause nausea vomiting difficult breathing or loss of
consciousness
Move to fresh air
If breathing has stopped give artificial respiration
If breathing is difficult give oxygen
LIQUID
Will burn skin and eyes
Harmful if swallowed
Remove contaminated clothing and shoes
Flush affected areas with plenty of water
IF IN EYES hold eyelids open and flush with plenty of water
IF SWALLOWED and victim is CONSCIOUS have victim drink water
or milk and have victim induce vomiting
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS do nothing except keep victim warm
Water pollution
HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS
May be dangerous if it enters water intakes
Notify local health and wildlife officials
Notify operators of nearby water intakes

Topic CARBON DISULFIDE

RESPONSE TO DISCHARGE
Issue warning-high flammability Restrict access Evacuate area
LABEL
Category Flammable liquid
Class 3
CHEMICAL DESIGNATIONS
CG compatibility class Carbon disulfide
Formula CS(2)
IMO/UN designation 3 1/1131
DOT id no 1131
CAS registry no 75-15-0
OBSERVABLE CHARACTERISTICS
Physical state Liquid
Color Colorless
Odor Faint sweetish disagreeable offensive like that of decaying cabbage
HEALTH HAZARDS
Personal protective equipment Only self contained breathing mask with full face approved by the United States Bureau of Mines is recommended If the vapor concentration exceeds 2/ by volume or is unknown supplied-air respiratory equipment of appropriate design with full face masks should be used by all persons entering contaminated area Masks should be used only for emergency situations and should be located accordingly Almost any type of industrial clothing is satisfactory Splashes of small quanity are not harmful to fabrics and evaporation from clothing is quite rapid Clothing should however be removed and the skin washed with water Goggles should be used when there is any danger of CS(2) splashes or spray
Symptoms following exposure ACUTE EXPOSURE mild to moderate irritation of skin eyes and mucous membranes from liquid or concentrated vapors headache garlicky breath nausea vomiting diarrhea (even after vapor exposures) and occasionally abdominal pain weak pulse palpitations fatigue weakness in the legs unsteady gait vertigo mania hallucinations of sight hearing taste and smell in acute massive vapor exposures central nervous depression with respiratory paralysis death may occur during coma or after a convulsion
Treatment of exposure INHALATION remove victim promptly from contaminated area Administer oxygen and artificial respiration if needed SKIN CONTACT wash affected areas with copious quantities of water INGESTION induce vomiting and follow with gastric lavage and saline cathartics
Threshold limit value 10 ppm
Short term inhalation limits 200 ppm for 10 minutes 100 ppm for 30 minutes and 50 ppm for 60 minutes
Toxicity by ingestion Grade 2 at LD(50) 0 1 - 0 99 g/ kg
Late toxicity Non-specific liver cell damage in rats high incidence of upper respiratory disease in humans
Vapor (or) irritant characteristics Vapors cause moderate

irritation such that personnel will find high concentrations unplesant The effect is temporary
Liquid or solid irritant characteristics Causes smarting of the skin and first-degree burns on short exposure and may cause secondary burns on long exposure
Odor threshold 0 21 ppm
IDLH value 500 ppm

FIRE HAZARDS
Flash point -22 degrees F C C
Flammable limits in air 1 3%-50/
Fire extinguishing agents Dry chemical carbon dioxide
Fire extinguishing agents NOT to be used Water and foam may be ineffective on fire
Special hazards of combustion products Toxic gases are generated wear self- contained breathing apparatus
Behavior in fire Not pertinent
Ignition temperature 212 degrees F
Electrical hazard Contact of the liquid or vapor with the surface of a lighted electric light bulb could result in ignition
Burning rate 2 7 mm/min
Adiabatic flame temperature Data not available
Stoichiometric air to fuel ratio Data not available
Flame temperature Data not available

CHEMICAL REACTIVITY
Reactivity with water No reaction
Reactivity with common materials No reaction
Stability during transport Stable
Neutralizing agents for acids and caustics Not pertinent
Polymerization Not pertinent
Inhibitor of polymerization Not pertinent
Molar ratio (reactant to product) Data not available
Reactivity group 38

WATER POLLUTION
Aquatic toxicity 35 ppm/48 hr/mosquito fish/TLm/fresh water
Waterfowl toxicity Data not available
Biological oxygen demand (BOD) Data not available
Food chain concentration potential None

SHIPPING INFORMATION
Grades of purity Commercial technical USP
Storage temperature Ambient
Inert atmosphere Inerted
Venting Pressure-vacuum

HAZARD CLASSIFICATIONS
Code of federal regulations Flammable liquid

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION

Category	Rating
Fire	4*
Health	
Vapor Irritant	2
Liquid or Solid Irritant	2
Poisons	3
Water Pollution	
Human Toxicity	1

Topic CARBON DISULFIDE

Aquatic Toxicity	2
Aesthetic Effect	3
Reactivity	
Other Chemicals	2
Water	0
Self Reaction	0

NFPA HAZARD CLASSIFICATION

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C and 1 ATM Liquid

Molecular weight 76 14

Boiling point at 1 ATM 115 degrees F 46 3 degrees C 319 5 degrees K

Freezing point -168 9 degrees F -111 6 degrees C = 161 6 degrees K

Critical temperature 523 degrees F - 273 degrees C - 546 degrees K

Critical pressure 1100 psia - 75 atm = 7 MN/m(2)

Specific gravity 1 26 at 20 degrees C (liquid)

Liquid surface tension 32 dynes/cm 032 N/m at 20 degrees C

Liquid water interfacial tension 48 4 dynes/cm = 0484 N/m at 20 degrees C

Vapor (gas) specific gravity 2

Ratio of specific heats of vapor (gas) 1 292

Latent heat of vaporization 153 Btu/lb 85 cal g - 3 55 10(5) J/kg

Heat of combustion -5814 Btu lb -3230 cal/g - -135 2 X 10(5 J/kg

Heat of decomposition Not pertinent

Heat of solution Not pertinent

Heat of polymerization Not pertinent

Heat of fusion 13 80 cal/g

Limiting value Data not available

Reid vapor pressure 10 3 psia

Topic 1 1-DICHLOROETHANE

OVERVIEW
Material name
1 1-DICHLOROETHANE
Common synonyms
Ethylidene chloride
Ethylidene dichloride
Chlorinated hydrochloric
ether
Characteristics
Oily liquid Colorless Chloroform like ethereal
Sinks and mixes with water
Emergency actions
Wear goggles self-contained breathing apparatus and
rubber overclothing (including gloves)
Stop discharge if possible Keep people away
Shut off ignition sources and call fire department
Avoid contact with liquid
Isolate and remove discharged material
Notify local health and pollution control agencies
Fire
Flammable
POISONOUS GAS MAY BE PRODUCED IN FIRE OR WHEN HEATED
Containers may explode in fire
Wear goggles and self-contained breathing apparatus
Extinguish with alcohol foam, carbon dioxide, or dry
chemical
Water may be ineffective on fire
Exposure
CALL FOR MEDICAL AID
LIQUID
If swallowed may cause nausea vomiting and faintness
Irritating to skin and eyes
Flush affected areas with plenty of water
IF IN EYES hold eyelids open and flush with plenty of
water
IF SWALLOWED and victim is CONSCIOUS have victim drink
water or milk
and induce vomiting
Water pollution
Dangerous to aquatic life in high concentrations
May be dangerous if it enters water intakes
Notify local health and wildlife officials
Notify operators of nearby water intakes
RESPONSE TO DISCHARGE
Issue warning-high flammability Restrict access Chemical
and physical treatment
LABEL
Category None
Class Not pertinent
CHEMICAL DESIGNATIONS
CG compatibility class Halogenated hydrocarbon
Formula C(2)H(4)Cl(2)
IMO/UN designation Not listed
DOT id no 2362
CAS registry no 75-34-3

Topic 1 1-DICHLOROETHANE

OBSERVABLE CHARACTERISTICS
Physical state Oily liquid
Color Colorless
Odor Chloroform
HEALTH HAZARDS
Personal protective equipment In areas of poor ventialtion or high concentration a self-contained breathing apparatus with full face mask should be worn Chemical workers goggles rubber gloves and protective clothing should be worn
Symptoms following exposure INHALATION Irritation of respiratory tract Salivation sneezing coughing, dizziness nausea and vomiting EYES Irritation lacrimation and reddening of conjunctiva SKIN Irritation Prolonged or repeated skin contact can produce a slight burn INGESTION Ingestion incidental to industrial handling is not considered to be a problem swallowing of substantial amounts could cause nausea vomiting faintness drowsiness cyanosis and circulator failure
Treatment of exposure Call a doctor INHALATION Remove from contaminated area keep warm and quiet If breathing has stopped give artificial respiration Administer oxygen EYES Flush with large amounts of water or weak bicarbonate of soda solution SKIN Dilute with large amounts of water Remove contaminated clothing INGESTION attempt to empty stomach dilute by administering fluids (tap water soapy water salt water or milk)
Threshold limit value 200 ppm
Short term inhalation limits 250 ppm
Toxicity by ingestion Grade 2 LD(50) = 0 5 to 5 g/kg (rat)
Late toxicity Chronic exposure may cause liver damage and dermatitis Animal experimentation has shown this compound to be slightly embryo-toxic and fetal development
Vapor (gas) irritant characteristics Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations The effect is temporary
Liquid or solid irritant characteristics Minimum hazard if spilled on clothing and allowed to remain may cause smarting and reddening of skin
Odor threshold Data not available
IDLH value 4 000 ppm
FIRE HAZARDS
Flash point 57 degrees F O C 22 degrees F C C
Flammable limits in air 5 6% to 11 4%
Fire extinguishing agents Alcohol foam water foam CO(2) dry chemical carbon tetrachloride
Fire extinguishing agents NOT to be used Water may be ineffective
Special hazards of combustion products When heated to decomposition emits highly toxic fumes to phosgene
Behavior in fire Explosion hazard
Ignition temperature 856 degrees F

Topic 1 1-DICHLOROETHANE

Electrical hazard Data not available
Burning rate Data not available
Adiabatic flame temperature Data not available
Stoichiometric air to fuel ratio Data not available
Flame temperature Data not available

CHEMICAL REACTIVITY
Reactivity with water No reaction
Reactivity with common materials Data not available
Stability during transport Data not available
Neutralizing agents for acids and caustics Data not available
Polymerization Data not available
Inhibitor of polymerization Data not available
Molar ratio (reactant to product) Data not available
Reactivity group 36

WATER POLLUTION
Aquatic toxicity TLm (Marine pinperch) 250 to 275 mg/l 24-hour TLm Brine shrimp 320 mg/l 24-hour TLm Pinperch 160 mg/l
Waterfowl toxicity Data not available
Biological oxygen demand (BOD) Percent 0 05 g/g for 10 days Percent 0 002 g/g for 5 days
Food chain concentration potential Data not available

SHIPPING INFORMATION
Grades of purity Data not available
Storage temperature Cool
Inert atmosphere Data not available
Venting Data not available

HAZARD CLASSIFICATIONS
Code of federal regulations Not listed
NAS hazard rating for bulk water transportation Not listed

NFPA HAZARD CLASSIFICATION

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

PHYSICAL AND CHEMICAL PROPERTIES
Physical state at 15 degrees C and 1 ATM Liquid
Molecular weight 98 97
Boiling point at 1 ATM 135 14 degrees F = 57 3 degrees C = 330 5 degrees K
Freezing point -143 32 degrees F = -97 4 degrees C = 175 75 degrees K
Critical temperature 502 7 degrees F = 261 5 degrees C = 534 65 degrees K
Critical pressure 734 8 psia = 50 atm = 5 065 MN/m(2)
Specific gravity 1 174 at 20 degrees C
Liquid surface tension 24 75 dynes/cm = 0 02475 N/m at 20 degrees C
Liquid water interfacial tension Data not available
Vapor (gas) specific gravity 3 42
Ratio of specific heats of vapor (gas) 1 136 at 20 degrees C (68 degrees F)
Latent heat of vaporization 131 6 Btu/lb = 73 1 cal/g = 3 06 x 10(5) J/kg

Topic 1 1-DICHLOROETHANE

Heat of combustion -4,774 Btu/lb = -2 652 cal/g = -111 X 10(5) J/kg
Heat of decomposition Data not available
Heat of solution Data not available
Heat of polymerization Data not available
Heat of fusion Data not available
Limiting value Data not available
REID vapor pressure 7 35 psia

Topic CARBON TETRACHLORIDE

OVERVIEW
Material name
CARBON TETRACHLORIDE
Common synonyms
Carbon Tet
Tetrachloromethane
Benzinoform
Necatorina
Perchloromethane
Characteristics
Watery liquid Colorless Sweet odor
Sinks in water Poisonous vapor is produced
Emergency actions
Avoid contact with liquid and vapor Keep people away
Wear goggles and self-contained breathing apparatus
Stop discharge if possible
Stay upwind and use water spray to knock down vapor
Notify local health and pollution control agencies
Fire
Not flammable
POISONOUS AND IRRITATING GASES ARE PRODUCED WHEN HEATED
Wear goggles and self-contained breathing apparatus
Exposure
CALL FOR MEDICAL AID
VAPOR
POISONOUS IF INHALED
Irritating to eyes
Move to fresh air
If breathing has stopped give artificial respiration
If breathing is difficult give oxygen
LIQUID
POISONOUS IF SWALLOWED
Irritating to skin and eyes
Remove contaminated clothing and shoes
Flush affected areas with plenty of water
IF IN EYES hold eyelids open and flush with plenty of water
IF SWALLOWED and victim is CONSCIOUS, have victim drink water
or milk and have victim induce vomiting
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS do nothing except keep victim warm
Water pollution
Effect of low concentrations on aquatic life is unknown
May be dangerous if it enters water intakes
Notify local health and pollution control officials
Notify operators of nearby water intakes
RESPONSE TO DISCHARGE
Issue warning-poison Restrict access Should be removed
LABEL
Category None
Class Not pertinent
CHEMICAL DESIGNATIONS
CG compatibility class Halogenated hydrocarbon
Formula CCl(4)

Topic CARBON TETRACHLORIDE

IMO/UN designation 6 1/1846
DOT id no 1846
CAS registry no 56-23-5

OBSERVABLE CHARACTERISTICS

Physical state Liquid
Color Colorless
Odor Sweetish aromatic moderately strong ethereal, somewhat resembling that of chloroform

HEALTH HAZARDS

Personal protective equipment Organic vapor canister with full face mask protective clothing rubber gloves
Symptoms following exposure Dizziness incoordination anesthesia may be accompanied by nausea and liver damage Kidney damage also occurs often producing decrease or stopping of urinary output
Treatment of exposure EYES AND SKIN flush with plenty of water for eyes get medical attention Remove contaminated clothing and wash before reuse INHALATION immediately remove to fresh air keep patient warm and quiet and get medical attention promptly Start artificial respiration if breathing stops INGESTION induce vomiting and get medical attention promptly No specific antidote known
Threshold limit value 5 ppm
Short term inhalation limits 25 ppm for 30 min
Toxicity by ingestion Grade 2 LD(50) - 0 5 to 5 g/kg (rat)
Late toxicity Causes severe liver damage and death if ingested
Vapor (gas) irritant characteristics Vapors cause moderate irritation such that personnel will find high concentrations unpleasant The effect is temporary
Liquid or solid irritant characteristics Minimum hazard If spilled on clothing and allowed to remain may cause smarting and reddening of the skin
Odor threshold Greater than 10 ppm
IDLH value 300 ppm

FIRE HAZARDS

Flash point Not flammable
Flammable limits in air Not flammable
Fire extinguishing agents Not pertinent
Fire extinguishing agents NOT to be used Not pertinent
Special hazards of combustion products Forms poisonous phosgene gas when exposed to open flames
Behavior in fire Decomposes to form chlorine and phosgene
Ignition temperature Not flammable
Electrical hazard Not pertinent
Burning rate Not flammable
Adiabatic flame temperature Data not available
Stoichiometric air to fuel ratio Data not available
Flame temperature Data not available

CHEMICAL REACTIVITY

Reactivity with water No reaction
Reactivity with common materials No reaction
Stability during transport Stable
Neutralizing agents for acids and caustics Not pertinent

Topic CARBON TETRACHLORIDE

Polymerization Not pertinent
Inhibitor of polymerization Not pertinent
Molar ratio (reactant to product) Data not available
Reactivity group 36

WATER POLLUTION

Aquatic toxicity Data not available
Waterfowl toxicity Data not available
Biological oxygen demand (BOD) None
Food chain concentration potential None

SHIPPING INFORMATION

Grades of purity Commercial technical USP
Storage temperature Ambient
Inert atmosphere No requirement
Venting Pressure-vacuum

HAZARD CLASSIFICATIONS

Code of federal regulations ORM-A

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION

Category	Rating
Fire	0
Health	
Vapor Irritant	2
Liquid or Solid Irritant	1
Poisons	4
Water Pollution	
Human Toxicity	2
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

NFPA HAZARD CLASSIFICATION

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	0

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C and 1 ATM Liquid
Molecular weight 153 83
Boiling point at 1 ATM 170 degrees F = 76 5 degrees C = 349 7 degrees K
Freezing point -9 4 degrees F = -23 0 degrees C = 250 2 degrees K
Critical temperature 541 degrees F = 283 degrees C = 556 degrees K
Critical pressure 660 psia = 45 atm = 4 6 MN/m(2)
Specific gravity 1 59 at 20 degrees C (liquid)
Liquid surface tension 27 0 dynes/cm = 0 027 N/m at 20 degrees C
Liquid water interfacial tension 45 0 dynes/cm = 0 045 N/m at 20 degrees C
Vapor (gas) specific gravity 5 3
Ratio of specific heats of vapor (gas) 1 111
Latent heat of vaporization 84 2 Btu/lb = 46 8 cal/g = 1 959 X 10(5) J/kg

Topic CARBON TETRACHLORIDE

Heat of combustion Not pertinent
Heat of decomposition Not pertinent
Heat of solution Not pertinent
Heat of polymerization Not pertinent
Heat of fusion 5 09 cal/g
Limiting value Data not available
REID vapor pressure 3 8 psia

Topic VINYLIDENE CHLORIDE

OVERVIEW

Material name

VINYLIDENE CHLORIDE

Common synonyms

1 1-Dichloroethylene

unsym-Dichloroethylene

Characteristics

Watery liquid Colorless Sweet odor

Sinks in water Flammable irritating vapor is produced

Boiling point is 89 degrees F

Emergency actions

Avoid contact with liquid and vapor Keep people away

Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves)

Shut off ignition sources and call fire department

Stop discharge if possible

Stay upwind and use water spray to knock down vapor

Evacuate area in case of large discharge

Isolate and remove discharged material

Notify local health and pollution control agencies

Fire

FLAMMABLE

POISONOUS GAS IS PRODUCED IN FIRE

Containers may explode in fire

Flashback along vapor trail may occur

Vapor may explode if ignited in an enclosed area

Wear self-contained breathing apparatus

Combat fires from safe distance or protected location

Extinguish with dry chemical foam, or carbon dioxide

Cool exposed containers with water

Exposure

CALL FOR MEDICAL AID

VAPOR

Irritating to eyes nose and throat

If inhaled will cause dizziness or difficult breathing

Move to fresh air

If breathing has stopped give artificial respiration

If breathing is difficult give oxygen

LIQUID

Will burn skin and eyes

Harmful if swallowed

Remove contaminated clothing and shoes

Flush affected areas with plenty of water

IF IN EYES hold eyelids open and flush with plenty of water

IF SWALLOWED and victim is CONSCIOUS have victim drink water

or milk

Water pollution

Effect of low concentrations on aquatic life is unknown

May be dangerous if it enters water intakes

Notify local health and wildlife officials

Notify operators of nearby water intakes

RESPONSE TO DISCHARGE

Issue warning-high flammability Evacuate area

Topic VINYLIDENE CHLORIDE

LABEL
Category Flammable liquid
Class 3
CHEMICAL DESIGNATIONS
CG compatibility class Vinyl halides
Formula CH(2)=CCl(2)
IMO/UN designation 3 1/1303
DOT id no 1303
CAS registry no 75-35-4
OBSERVABLE CHARACTERISTICS
Physical state Liquid
Color Colorless
Odor Sweet like carbon tetrachloride or chloroform
HEALTH HAZARDS
Personal protective equipment Approved canister or air-supplied mask goggles or face shield rubber gloves and boots
Symptoms following exposure Vapor can cause dizziness and drunkenness high levels cause anesthesia Liquid irritates eyes and skin
Treatment of exposure INHALATION if any illness develops remove person to fresh air promptly keep warm and quiet and get medical attention if breathing stops start artificial respiration INGESTION not likely a problem no known antidote treat symptomatically EYES OR SKIN flush with plenty of water for at least 15 min get medical attention for eyes remove contaminated clothing and wash before reuse
Threshold limit value 10 ppm
Short term inhalation limits Data not available
Toxicity by ingestion Grade 3 Oral LD(50) = 24 hr = 84 mg/kg (adrenalectomized rat)
Late toxicity Data not available
Vapor (gas) irritant characteristics Vapors cause moderate irritation such that personnel will find high concentrations unpleasant The effect is temporary
Liquid or solid irritant characteristics Causes smarting of the skin and first-degree burns on short exposure may cause secondary burns on long exposure
Odor threshold Data not available
IDLH value Data not available
FIRE HAZARDS
Flash point 0 degrees F O C
Flammable limits in air 7 3/-16 0/
Fire extinguishing agents Foam carbon dioxide dry chemical
Fire extinguishing agents NOT to be used Water may be ineffective
Special hazards of combustion products Toxic hydrogen chloride and phosgene are generated in fires
Behavior in fire May explode in fire due to polymerization Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back
Ignition temperature 955-1031 degrees F

Electrical hazard Not pertinent
Burning rate 2 7 mm/min
Adiabatic flame temperature: Data not available
Stoichiometric air to fuel ratio Data not available
Flame temperature Data not available

CHEMICAL REACTIVITY
Reactivity with water No reaction
Reactivity with common materials Copper and aluminum can cause polymerization
Stability during transport Stable
Neutralizing agents for acids and caustics Not pertinent
Polymerization Can occur if exposed to sunlight air copper aluminum heat
Inhibitor of polymerization 200 ppm methyl ether of hydroquinone 0 6-0 8% phenol
Molar ratio (reactant to product) Data not available
Reactivity group 35

WATER POLLUTION
Aquatic toxicity Data not available
Waterfowl toxicity Data not available
Biological oxygen demand (BOD) Data not available
Food chain concentration potential None

SHIPPING INFORMATION
Grades of purity 99/
Storage temperature Ambient
Inert atmosphere Padded
Venting Pressure-vacuum

HAZARD CLASSIFICATIONS
Code of federal regulations Flammable liquid

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION

Category	Rating
Fire	3
Health	
Vapor Irritant	2
Liquid or Solid Irritant	2
Poisons	3
Water Pollution	
Human Toxicity	0
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	2
Water	0
Self Reaction	3

NFPA HAZARD CLASSIFICATION

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	4
Reactivity (Yellow)	2

PHYSICAL AND CHEMICAL PROPERTIES
Physical state at 15 degrees C and 1 ATM Liquid
Molecular weight 96 95
Boiling point at 1 ATM 88 9 degrees F = 31 6 degrees C = 304 8 degrees K
Freezing point -187 6 degrees F = 122 0 degrees C - 151 2

Topic VINYLIDENE CHLORIDE

degrees K
Critical temperature Not pertinent
Critical pressure Not pertinent
Specific gravity 1 21 at 20 degrees C (liquid)
Liquid surface tension 24 dynes/cm = 0 024 N/m at 15 degrees C
Liquid water interfacial tension 37 dynes/cm = 0 037 N/m at 22 7 degrees C
Vapor (gas) specific gravity 3 3
Ratio of specific heats of vapor (gas) Data not available
Latent heat of vaporization 130 Btu/lb = 72 cal/g = 3 0 X 10(5) J/kg
Heat of combustion -4860 Btu/lb = -2700 cal/g = -113 0 X 10(5) J/kg
Heat of decomposition Not pertinent
Heat of solution Not pertinent
Heat of polymerization -333 Btu/lb = 185 cal/g - -7 75 X 10(5) J/kg
Heat of fusion Data not available
Limiting value Data not available
REID vapor pressure 18 3 psia

Topic 1 2-DICHLOROETHYLENE

OVERVIEW
Material name
1 2-DICHLOROETHYLENE
Common synonyms
Acetylene dichloride
sym-dichloroethylene
Dioform
cis-1 2-dichloroethylene
trans-1 2-dichloroethylene
Characteristics
Liquid Colorless Sweet pleasant odor
Sinks in water Flammable irritating vapor is produced
Emergency actions
Wear goggles and self-contained breathing apparatus
Shut off ignition sources Call fire department
Stop discharge if possible Keep people away
Isolate and remove discharged material
Notify local health and pollution control agencies
Fire
FLAMMABLE
POISONOUS GASES MAY BE PRODUCED IN FIRE
Containers may explode in fire
Flashback along vapor trail may occur
Vapor may explode if ignited in an enclosed area
Extinguish with dry chemicals foam or carbon dioxide
Water may be ineffective on fire
Cool exposed containers with water
Exposure
Call for medical aid
VAPOR
If inhaled will cause dizziness nausea vomiting or difficult breathing
Move victim to fresh air
If breathing has stopped give artificial respiration
If breathing is difficult give oxygen
LIQUID
Harmful if swallowed
IF SWALLOWED and victim is CONSCIOUS have victim drink water
or milk
Water pollution
Effect of low concentrations on aquatic life is unknown
May be dangerous if it enters water intakes
Notify local health and wildlife officials
Notify operators of nearby water intakes
RESPONSE TO DISCHARGE
Issue warning-high flammability Restrict access Evacuate area Should be removed Chemical and physical treatment
LABEL
Category Flammable liquid
Class 3
CHEMICAL DESIGNATIONS
CG compatibility class Not listed
Formula ClCH = CHCl
IMO/UN designation 3 2/1150

Topic 1 2-DICHLOROETHYLENE

DOT id no 1150
CAS registry no 540-59-0

OBSERVABLE CHARACTERISTICS
Physical state Liquid
Color Colorless
Odor Ethereal slightly acrid pleasant chloroform-like

HEALTH HAZARDS
Personal protective equipment Rubber gloves safety goggles air supply mask or self- contained breathing apparatus
Symptoms following exposure Inhalation causes nausea vomiting weakness tremor epigastric cramps central nervous depression Contact with liquid causes irritation of eyes and (on prolonged contact) skin Ingestion causes slight depression to deep narcosis
Treatment of exposure INHALATION remove from further exposure if breathing is difficult give oxygen if victim is not breathing, give artificial respiration preferably mouth-to-mouth give oxygen when breathing is resumed call a physician EYES flush with water for at least 15 min SKIN wash well with soap and water INGESTION give gastric lavage and cathartics
Threshold limit value 200 ppm
Short term inhalation limits Data not available
Toxicity by ingestion Grade 2 oral LD(50) = 770 mg/kg rat)
Late toxicity Produces liver and kidney injury in experimental animals
Vapor (gas) irritant characteristics Data not available
Liquid or solid irritant characteristics Data not available
Odor threshold Data not available
IDLH value 4 000 ppm

FIRE HAZARDS
Flash point 37 degrees F C C
Flammable limits in air 9 7/-12 8/
Fire extinguishing agents Dry chemical foam carbon dioxide
Fire extinguishing agents NOT to be used Water may be ineffective
Special hazards of combustion products Phosgene and hydrogen chloride fumes may form in fires
Behavior in fire Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back
Ignition temperature 860 degrees F
Electrical hazard Data not available
Burning rate 2 6 mm/min
Adiabatic flame temperature Data not available
Stoichiometric air to fuel ratio Data not available
Flame temperature Data not available

CHEMICAL REACTIVITY
Reactivity with water No reaction
Reactivity with common materials No reaction
Stability during transport Stable

Neutralizing agents for acids and caustics Not pertinent
Polymerization Will not occur under ordinary conditions of shipment The reaction is not vigorous
Inhibitor of polymerization: None used
Molar ratio (reactant to product) Data not available
Reactivity group Data not available

WATER POLLUTION

Aquatic toxicity Data not available
Waterfowl toxicity Data not available
Biological oxygen demand (BOD) Data not available
Food chain concentration potential None

SHIPPING INFORMATION

Grades of purity Commercial
Storage temperature Ambient
Inert atmosphere No requirement
Venting Pressure-vacuum

HAZARD CLASSIFICATIONS

Code of federal regulations Flammable liquid
NAS hazard rating for bulk water transportation Not listed

NFPA HAZARD CLASSIFICATION

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	2

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C and 1 ATM Liquid
Molecular weight 97 0
Boiling point at 1 ATM cis 140 degrees F = 60 degrees C = 333 degrees K trans 118 degrees F = 48 degrees C = 321 degrees K
Freezing point cis -114 degrees F = -81 degrees C = 192 degrees K trans -58 degrees F = -50 degrees C = 223 degrees K
Critical temperature Not pertinent
Critical pressure Not pertinent
Specific gravity 1 27 at 25 degrees C (liquid)
Liquid surface tension 24 dynes/cm = 0 024 N/m at 20 degrees C
Liquid water interfacial tension (est) 30 dynes/cm = 0 030 N/m at 20 degrees C
Vapor (gas) specific gravity 3 34
Ratio of specific heats of vapor (gas) 1 1468
Latent heat of vaporization 130 Btu/lb = 72 cal/g = 3 0 X 10(5) J/kg
Heat of combustion -4 847 2 Btu/lb = -2 692 9 cal/g = -112 67 X 10(5) J/kg
Heat of decomposition Not pertinent
Heat of solution Not pertinent
Heat of polymerization Not pertinent
Heat of fusion Data not available
Limiting value Data not available
REID vapor pressure Data not available

Topic TRICHLOROETHYLENE

OVERVIEW
Material name
TRICHLOROETHYLENE
Common synonyms
Trichloroethylene
Triclene Algylen
Chlorylen
Gemalgene
Trethylene
Trichloran Trilene
Characteristics
Watery liquid Colorless Sweet odor
Sinks in water Irritating vapor is produced
Emergency actions
Stop discharge if possible Keep people away
Avoid contact with liquid and vapor
Call fire department
Isolate and remove discharged material
Notify local health and pollution control agencies
Fire
Combustible
POISONOUS GASES ARE PRODUCED IN FIRE
Wear goggles and self-contained breathing apparatus
Extinguish with dry chemical carbon dioxide or foam
Exposure
CALL FOR MEDICAL AID
VAPOR
Irritating to eyes nose and throat
If inhaled will cause nausea vomiting difficult breathing
or loss of consciousness
Move to fresh air
If breathing has stopped give artificial respiration
If breathing is difficult give oxygen
LIQUID
Irritating to skin and eyes
If swallowed will cause nausea vomiting difficult breathing
or loss of consciousness
Remove contaminated clothing and shoes
Flush affected areas with plenty of water
IF IN EYES hold eyelids open and flush with plenty of water
IF SWALLOWED and victim is CONSCIOUS have victim drink water
or milk and have victim induce vomiting
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS do nothing except keep victim warm
Water pollution
Effect of low concentrations on aquatic life is unknown
May be dangerous if it enters water intakes
Notify local health and wildlife officials
Notify operators of nearby water intakes
RESPONSE TO DISCHARGE
Should be removed Chemical and physical treatment

Topic TRICHLOROETHYLENE

LABEL
Category None
Class Not pertinent
CHEMICAL DESIGNATIONS
CG compatibility class Halogenated hydrocarbon
Formula CHCl=CCl(2)
IMO/UN designation 9 0/1710
DOT id no 1710
CAS registry no 79-01-6
OBSERVABLE CHARACTERISTICS
Physical state Liquid
Color Colorless
Odor Chloroform-like ethereal
HEALTH HAZARDS
Personal protective equipment Organic vapor-acid gas canister self-contained breathing apparatus for emergencies neoprene or vinyl gloves chemical safety goggles face-shield neoprene safety shoes neoprene suit or apron for splash protection
Symptoms following exposure INHALATION symptoms range from irritation of the nose and throat to nausea an attitude of irresponsibility blurred vision, and finally disturbance of central nervous system resulting in cardiac failure Chronic exposure may cause organic injury INGESTION symptoms similar to inhalation SKIN defatting action can cause dermatitis EYES slightly irritating sensation and lachrymation
Treatment of exposure Do NOT administer adrenalin or epinephrine get medical attention for all cases of overexposure INHALATION remove victim to fresh air if necessary, apply artificial respiration and/or administer oxygen INGESTION have victim drink water and induce vomiting repeat three times then give 1 tablespoon epsom salts in water EYES flush thoroughly with water SKIN wash thoroughly with soap and warm water
Threshold limit value 50 ppm
Short term inhalation limits 200 ppm for 30 min
Toxicity by ingestion Grade 3 LD(50) = 50 to 500 mg/kg
Late toxicity Data not available
Vapor (gas) irritant characteristics Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations The effect is temporary
Liquid or solid irritant characteristics Minimum hazard If spilled on clothing and allowed to remain may cause smarting and reddening of the skin
Odor threshold 50 ppm
IDLH value 1 000 ppm
FIRE HAZARDS
Flash point 90 degrees F C C practically nonflammable
Flammable limits in air 8 0/-10 5/
Fire extinguishing agents Water fog
Fire extinguishing agents NOT to be used Not pertinent
Special hazards of combustion products Toxic and irritating gases are produced in fire situations
Behavior in fire Not pertinent

Topic TRICHLOROETHYLENE

Ignition temperature 770 degrees F
Electrical hazard Not pertinent
Burning rate Not pertinent
Adiabatic flame temperature Data not available
Stoichiometric air to fuel ratio Data not available
Flame temperature Data not available

CHEMICAL REACTIVITY
Reactivity with water No reaction
Reactivity with common materials No reaction
Stability during transport Stable
Neutralizing agents for acids and caustics Not pertinent
Polymerization Not pertinent
Inhibitor of polymerization Not pertinent
Molar ratio (reactant to product) Data not available
Reactivity group 36

WATER POLLUTION
Aquatic toxicity 660 mg/l/40 hr/daphnia/kill/fresh water
Waterfowl toxicity Data not available
Biological oxygen demand (BOD) Data not available
Food chain concentration potential None

SHIPPING INFORMATION
Grades of purity Technical dry cleaning degreasing extraction
Storage temperature Ambient
Inert atmosphere No requirement
Venting Pressure-vacuum

HAZARD CLASSIFICATIONS
Code of federal regulations ORM-A

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION

Category	Rating
Fire	1
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	1

NFPA HAZARD CLASSIFICATION

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Reactivity (Yellow)	0

PHYSICAL AND CHEMICAL PROPERTIES
Physical state at 15 degrees C and 1 ATM Liquid
Molecular weight 131 39
Boiling point at 1 ATM 189 degrees F = 87 degrees C = 360 degrees K
Freezing point -123 5 degrees F = -86 4 degrees C = 186 8 degrees K

Topic: TRICHLOROETHYLENE

Critical temperature Not pertinent
Critical pressure Not pertinent
Specific gravity 1 46 at 20 degrees C (liquid)
Liquid surface tension 29 3 dynes/cm = 0 0293 N/m at 20 degrees C
Liquid water interfacial tension 34 5 dynes/cm = 0 0345 N/m at 24 degrees C
Vapor (gas) specific gravity 4 5
Ratio of specific heats of vapor (gas) 1 116
Latent heat of vaporization: 103 Btu/lb = 57 2 cal/g = 2 4 X 10(5) J/kg
Heat of combustion Not pertinent
Heat of decomposition Not pertinent
Heat of solution Not pertinent
Heat of polymerization Not pertinent
Heat of fusion Data not available
Limiting value Data not available
REID vapor pressure 2 5 psia